OBSCURITY AND CONFUSION

NONREDUCTIONISM IN DESCARTES'S BIOLOGY AND PHILOSOPHY

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Proefschrift voorgelegd tot het behalen van de graad van Doctor in de Wijsbegeerte
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Introduction

0.1 Introduction

This dissertation makes a case for Descartes's being a nonreductionist, in at least some areas of his philosophy. It first gives a reading of Descartes's biology, in which I argue that he is not a strict reductionist about the mechanisms of the body (because those mechanisms rely on non-lowest-level properties of systems), that his 'principle of life and motion' is explicable only in terms of the whole body (or its major systems), and that he has no reductionist account of life. I then argue that this nonreductionism is compatible with Descartes's wider philosophy. I give a reading of his treatment of the union of mind and body in terms of irreducibility, which I then use to argue that Descartes's philosophy allows for nonreductionist knowledge and the existence of irreducibles (the union itself, teleology, and, finally, life). Indeed, I end up claiming, Descartes's philosophy could not work without this nonreductionist knowledge and without those irreducibles. That is because reductionism fails him. Given his system, he cannot reductively explain the operation of biological bodies, the interaction of thought and extension, or possibly even physical causation. Nonreductionism saves him from what would otherwise be explanatory dead ends.

It is admittedly somewhat odd, though, to read Descartes as a nonreductionist. He is explicitly, famously committed to reductionism, broadly conceived.[1] Indeed, it would not be much of a stretch to describe him as the archetypal philosophical reductionist – we see this much in the throwaway remarks on Descartes that often come up in the introductions to papers on reductionism in philosophy of science and science studies. Descartes, we're told, 'was the first to introduce reductionism to Western thinking and philosophy' (Mazzocchi 2008: 10); reductionism 'is identified with René Descartes' (Trewavas 2006: 2420); and, even if reductionism has a history prior to Descartes, it was supposedly he who 'later re-introduced' it to science (Beresford 2010: 721). These are all just superficial references to Descartes, of course, which are used only to provide a little scene-setting for arguments that are not at all concerned with Descartes or the seventeenth century. Given that, their superficiality is perfectly reasonable, but it's also revealing. It's revealing in that it indicates the degree to which the association with reductionism permeates the general (non-specialist) conception of Descartes's natural philosophy: 'as an aside', these references seem to say, 'all our modern concern with reductionism goes back to Descartes'. And it is not only nonspecialists who associate Descartes with reductionism. As Grosholz puts it, '[m]uch of modern philosophy bears the traces of Descartes's reductive method [. . .], and requires prolonged and deep philosophical criticism in order to make that influence visible, and so subject to further reflection' (1991: 10).

This association with reductionism is well supported by Descartes's texts. In the *Discourse on the Method*, written as a methodological introduction to his essays on optics, meteorology, and geometry, Descartes sets out his approach in general terms:

> [. . .] never to accept anything as true if I did not have evident knowledge of its truth [. . .].
>
> [. . .] to divide each of the difficulties I examined into as many parts [*parcelles*] as possible and as may be required in order to resolve them better.
>
> [. . .] to direct my thoughts in an orderly manner, by beginning with the simplest and most easily known objects [*objets*] in order to ascend little by little, step by step, to knowledge of the most complex [*plus composez*]
>
> (CSM i: 120; AT vi: 18).

[1] Broadly conceived because Descartes can readily be associated with various forms of reductionism: his ontological parsimony lends itself to ontological reductionism, as does his epistemic parsimony to epistemic reductionism, and his commitment to the unity of the sciences seems, at least to an extent, to tie in with theory reductionism, and so on for different subtypes of reductionism. See Grosholz (1991: 12–3).

It is easy to read this as a kind of explanatory reductionism – as the recommendation to break higher-level problems[2] down into their lowest-possible-level parts. Those lowest-level parts should be well-grounded, such that we have 'evident knowledge' of their truth. On that basis, we should build up knowledge of complex things from knowledge of their parts; we should explain higher levels on the basis of the lowest level.

Descartes's ontology, too, suggests reductionism – in this case, an ontological reductionism. As he sets it out in the textbook version of his system, the *Principles of Philosophy*,

> I recognize only two ultimate classes of things: first, intellectual or thinking things, i.e. those which pertain to mind or thinking substance; and secondly, material things, i.e. those which pertain to extended substance or body
>
> (*Principles* 1/48; CSM i: 208; AT viiiA: 23).

He continues, to specify that

> extension in length, breadth and depth constitutes the nature of corporeal substance; and thought constitutes the nature of thinking substance. *Everything else which can be attributed to body presupposes extension, and is merely a mode of an extended thing; and similarly, whatever we find in the mind is simply one of the various modes of thinking*
>
> (*Principles* 1/53; CSM i: 210; AT viiiA: 25; my emphasis).

That is, the world consists of nothing but thinking substance and extended substance. Whatever there might seem to be in the world, it can ultimately be nothing other than a modification of thought or extension; whatever there seems to be, it must, exclusively, reduce down to thinking substance or extended substance. Similarly, if we want to explain what there is in the world, and what happens within it, these are the terms we need: thought, extension, and their respective modifications. In the natural, material world, that means that all phenomena, and all explanations thereof, ought to come down to nothing more than the 'size, shape, and motion of the tiny parts that make it up' (Garber 2001d: 112). This call to reductionism is emphasised by Descartes's explicit promotion of his notoriously austere ontology, and its explanatory capabilities, over the relative ontological extravagance of what he takes to be the superfluous forms, qualities, powers, souls, etc. used in the then-mainstream scholastic philosophy (e.g. AT iii: 648–9; AT vi: 45–6; AT xi: 7; AT xi: 202).

[2] In context, Descartes is concerned with the reduction of problems here, but his use of 'objects' might suggest an ontological reductionism too.

There are, then, plenty of good reasons to take Descartes to be a reductionist through and through: his ontology allows only a very narrow range of things into the world, and his epistemology depends on the reconstitution of complex knowledge from those basic truths of which we have evident knowledge. That evident knowledge is what Descartes comes to call 'clear and distinct' knowledge. It is, again, easy to interpret Cartesian clarity and distinctness as the lowest level for an epistemological reductionism. As McMullin sums it up,

> [Descartes's] insistence in his epistemology on the primacy of clear and distinct ideas leads him to an extreme form of reductionism in his ontology where all that he admits are "bodies which are extended in length, breadth, and depth, and which have various shapes and move in various ways." That, he says, is all he needs "to deduce the truth of other things" (Principles: 1:184; AT 9B:10).
>
> [. . .]
>
> Reduction on this scale forces him to a new level of explanation, one which has no parallel in Aristotelian natural philosophy. Properties like color and weight which are simple givens for Aristotle now have to be explained (or explained away) in terms of extensions (or bodies) and motion alone, a daunting task for anyone less committed to clear and distinct ideas than was Descartes
>
> (McMullin 2008: 88–9).

One of the major messages of the *Meditations* is that clarity and distinctness is our epistemic saviour. Clarity and distinctness is our only means of metaphysical certainty (AT vii: 62). It's the fulcrum with which Descartes means to shift the earth (AT vii: 24), and so on. Its opposite is obscurity and confusion. When something is obscure, it is obscured by something else; when it's confused, it is combined with something else.[3] That is, we have obscurity and confusion when we have unreduced complexes. In which case, it is the aim of a reductionist epistemology to rid us of obscurity and confusion – to reduce those complexes down to the clear and distinct lowest level. On the reductionist reading, all epistemic value lies in clarity and distinctness, while whatever is obscure or confused is nothing but an impediment to knowledge, and is in need of reduction.

In that light, this dissertation is an attempt to rehabilitate obscurity and confusion. That's not to say that it is an analysis of the categories: it is not. Rather, obscurity and confusion (confusion in particular) are the ghosts that haunt the nonreductionism that I address here; I am attempting to show that they are friendly ghosts. Unreduced

[3] Descartes himself makes extensive use of the terms, but does not define 'obscurity' and 'confusion' outright; I follow Nelson's (1997) very convincing reading here. For more on this, see Ch. 5, §5.4.1.

complexes, I argue throughout, are not just epistemic impediments for Descartes: they have epistemic value of their own; they can do things that the lowest levels cannot. Thus, Descartes explains the heartbeat using non-lowest-level properties of systems, because efficient causation between corpuscles fails to be sufficiently explanatory (Ch. 1); he has no means of reducing various kinds of teleology to the properties of extended substance, and yet he relies heavily on natural teleology (Ch. 6 §6.3); and so on – I make similar cases for various biological mechanisms (Ch. 1), the 'principle of life' (Ch. 2), life itself (Ch. 3 and Ch. 6, §6.4), and the union of mind and body (Ch. 4 and Ch. 6, §6.2). In this way, clarity and distinctness does not always confer knowledge; sometimes, it prevents it.[4] Sometimes, it is only through obscurity and confusion – through the nonreductionist knowledge of unreduced complexes – that Descartes can adequately account for the world.

There is nothing new in pointing out that Descartes helps himself to things he should not, given their preclusion in his system. The relatively recent work on Descartes's biology and associated areas has been especially fruitful to this end. Natural teleology is a notable case, and has so far received the most attention.[5] Des Chene (2001) points to more problematic things, including the unity of the animal body and (in-principle-reducible) systems. And Brown (2012), in attempting to account for one (function in Descartes's embryology), identifies what I take to be another (interdependence – see Ch. 1, §1.3.1.1 and Ch. 2, §2.4.2). The first half of this dissertation serves to identify more such cases. The second half then establishes a context of reductionism and nonreductionism in which to address them, and makes a case for the coherence of irreducibles within Descartes's philosophy.

0.2 Outline

The structure of the dissertation is as follows. In the first part (Chs 1–3), I show that Descartes's account of physiology depends on nonreductionism to explain the operation of the body. The chapters that make up the first part of the dissertation were all written for independent publication, and are lightly modified here. Chapter One looks as Descartes's use of mechanism in his accounts of physiological phenomena.

[4] Clarity and distinctness prevents knowledge in that the clear and distinct ideas of Descartes's dualist system can tell us nothing about the union (or, I argue in Ch. 6, about natural teleology or life).

[5] See, e.g., Gaukroger (2000), Des Chene (2001; 2000a), Simmons (2001), Shapiro (2003) (note that Shapiro explicitly attempts to provide Descartes with a reductionist account of natural teleology in the form of health), Manning (2013), and Distelzweig (2015).

Cartesian mechanism gets strongly associated with reductionism, for the reasons discussed above – it is supposed to be the reduction of natural phenomena to the shape, size, position, and motion of tiny, material corpuscles. Here, I refer to the latter position as 'corpuscular mechanics', and I argue that the mechanisms Descartes uses to account for physiology are rarely ever corpuscular-mechanical. While he does reduce physiological phenomena to the material, he does not reduce them to the lowest level: he is not a strict reductionist about biological mechanism. The chapter builds on the work of Des Chene (2001) to argue that, for the most part, Descartes accounts for physiology through systems that are irreducible to corpuscular mechanics; any further reduction would rob them of their explanatory power.

In Chapter Two, I assess Descartes's 'principle of life' and argue that the body, on his account, has no single principle underlying its operation. In the Aristotelian biologies that Descartes takes himself to be responding to, the principle of life is attributed to a soul, or to part of a soul. That is, broadly speaking, there is one, single thing that 'drives' the body, and to which all its operations are ultimately reducible. When Descartes takes on the 'principle of life' terminology, it looks as though he has something similar in mind. It looks as though he is swapping the psychistic principle for a material principle, while leaving the structure of the body's operation in place – that is, making its operation ultimately reducible to a single thing. He appears to associate that single thing with the heat of the heart. The trouble is, I argue, that Descartes's account of cardiac heat makes it inextricable from the operation of several interdependent bodily systems. Rather than the operations of the body bottoming out in a single, underlying principle, they end up in circular causality: there is no lowest level to which they are reducible.

Chapter Three moves on from the principle of life to Descartes's account of life itself. It argues that he has, and can have, no reductionist account of life. It assesses the various attempts in the literature to provide Descartes with a reductionist concept of life and shows where they fail (in some cases, the attempts involved are explicit about their own failure (Ablondi 1998; Detlefsen 2016)). It then argues that Descartes's ontology lacks the resources to ground a principled, reductionist conception of life. I conclude that, for the purposes of his biology, Descartes eliminates the category of life entirely. The conclusions of this chapter are then taken up again in Chapter Six (§6.4), where I argue that this eliminativism is compatible with a metaphysical treatment of life as an irreducible.

The second part of the dissertation argues that nonreductionism is both a legitimate possibility for and a necessity within Descartes's philosophy. Its aim is to bridge the apparent inconsistency between Descartes's explicit endorsement of a reductionist position in his epistemology and ontology with his use of nonreductionism. My intention is to construct a coherent reading in which Descartes does indeed get access to nonreductionist knowledge and can (and must) uphold the existence of irreducibles.[6]

Chapter Four gives a reading of the Cartesian union of mind and body as an irreducible. It starts from Descartes's responses to the problem of mind–body interaction, in which he claims that the union is a primitive notion that cannot be comprehended in the terms of his dualism but which we nevertheless know through 'the ordinary course of life' (CSMK: 227; AT iii: 692). I argue that this position entails that there is an epistemic gap in Descartes's dualist system when it comes to the union: the union is something that his dualism cannot explain. This means that Descartes has to abandon the epistemology that pertains to his dualism in order to account for our knowledge of the union. This entails that he sustain a separate epistemology that pertains to the union. The chapter reconstructs the epistemology implicit in Descartes's account of the union. It then argues that Descartes has to equivocate between the two epistemologies to fill the epistemic gap in his dualism. This means, then, that there is nonreductionism at the heart of Descartes's philosophy.

In Chapter Five, I assess the role of reductionism in Cartesian knowledge, with the aim of showing where it need apply and where (as addressed in Ch. 6) it need not. I argue, uncontroversially, that the majority of Descartes's process of acquiring knowledge involves sensation in observation and experimentation. The role of reduction in this, the chapter concludes, is to provide grounds for asserting the independent existence of external things with their particular essences. That is, while our obscure and confused sensations cannot tell us what the world is like in itself, we can know that the reductions of those sensations to the elements of Descartes's ontology tell us what does exist in itself: the colour red might not exist as the colour red independent of our perception of it, but the rotational movement of tiny corpuscles propagating light to which Descartes reduces it does.

I draw on this conclusion in Chapter Six to argue that all that Cartesian nonreductionist knowledge gives up is knowledge of independent existence: nonreductionist knowledge can tell us about the non-independent existence of external

[6] On why I'm aiming for a coherent reading rather than maintaining that Descartes's project is simply inconsistent, see §0.3 below.

things with their particular essences. We can still have knowledge of external things nonreductively, but we cannot say anything about what they might be in themselves, independent of us. Cartesian nonreductionist epistemology is thus a subjective standpoint epistemology, as opposed to the objective epistemology he gets through reductionism. I argue that he can maintain both. The chapter gives accounts of nonreductionist knowledge first of the union, and then of natural teleology. Descartes treats both, it argues, as irreducibles whose existence can only be known subjectively. Finally, I come back to life, and argue that, despite his eliminativism about life for the purposes of his biology, Descartes has a weak metaphysical commitment to life itself as an irreducible.

0.3 Methodology

My intention, in this dissertation, is not to find the original meaning behind Descartes's texts, or to get to some historical truth about them. In that way, the dissertation is non-historicist. Nor is my approach to analyse timeless arguments, though. The approach here is to find some implications of what Descartes writes, with respect to reductionism and nonreductionism. In other words, the dissertation is concerned with the interpretative possibilities for Descartes's system. I take it that philosophies have lives of their own, and that the author's intentions are fairly restricted guides to those lives. Descartes might or might not have meant his work to imply nonreductionism; nevertheless (I am arguing here), it does. With that in mind, I've tended to focus on Descartes's accounts of various things (such as biological phenomena or the union of mind and body) rather than his overt statements about his methodology and the role of reduction within it. The point here is to be concerned with the philosophical consequences of the accounts Descartes gives, rather than with what he claims to be doing – while he might endorse reductionism explicitly, the way he treats biology and the union shows considerable reliance on nonreductionism (that is, if the analysis here works).

One way to deal with this disparity would be to interpret Descartes's work as simply inconsistent. This is fine, as far as it goes: there undoubtedly are inconsistencies in Descartes's work, some developmental, and some possibly more insidious.[7] But my approach here instead is to look for a reading that generates some coherence from that inconsistency. That's because I take it that it's philosophically productive to see how far a system can be pushed. And Descartes has a system that is in particular need of being

[7] Machamer and McGuire (2009) have recently made an excellent case for the inconsistency of Descartes's philosophy and, to an extent, the value of that inconsistency.

pushed. His is quite possibly unique in its combination of influence, extensiveness, rigidity, explicitness, and well-definedness. And the association of reductionism with that system is still particularly widespread, to the extent that Descartes is still the default historical framing device for any number of nonspecialist works on the subject (as we've seen). My aim here is to recruit Descartes for the other side. I want to make him a nonreductionist (because, if the archetypal reductionist turns out to be a nonreductionist, then pure reductionism ought to find itself standing on somewhat shakier ground). That would be a vacuous, and arbitrary, exercise if his system did not support such a reading, of course: it would be pointless to claim that Descartes is a nonreductionist without any basis for that claim. And while it would not be vacuous to show that, despite himself, Descartes is sometimes inconsistently nonreductionist, that position would be weaker than a reading that maintains the coherence of Descartes's system while interpreting it as fundamentally (if not exclusively) nonreductionist.

What I am doing in this dissertation, then, is turning Descartes into something very different from what we have come to believe he is. Whether that is historically legitimate, I am not sure (that might be a matter for further research). But it is possible, while still staying coherent with his texts. And that is what I'm interested in here. I am aware that I have used variations on the phrase 'that's surprising' repeatedly throughout this dissertation. I suspect it gets fairly tedious. But this is a dissertation that makes what, at first, sound like very odd claims. It claims that Descartes is a nonreductionist, that he can be a non-corpuscularian, that he has no principle of life (despite claiming to), that the union of mind and body have some sort of priority over thought and extension, that he has another domain of knowledge outside his dualism, and that he is both an eliminativist about life and some sort of vitalist. If that can end up seeming non-surprising, the dissertation will have done its job reasonably well.

Part 1

Nonreductionism in Descartes's biology

Chapter 1

Descartes, corpuscles and reductionism: mechanism and systems in Descartes's physiology[1]

1.1 Introduction

This chapter is a reconstruction of Descartes's approach to physiology in which his explanations of the principal operations of the body are understood in terms of systems. A systems reading of Descartes's physiology is at odds with the received view on explanation in Descartes's natural philosophy, which takes him to reduce all phenomena in the natural world to the size, shape, position, and motion of tiny corpuscles (see the introduction, p. 3 above). A systems explanation cannot be a reduction right down to this corpuscular mechanics, because it is the system itself that carries the explanatory weight, rather than its lowest-level components.

Elsewhere in his natural philosophy, Descartes arguably does make use of explanations in terms of corpuscular mechanics (but see §1.3.3 for discussion of whether even his physics is corpuscular-mechanical). Most notably, the propagation and colour of light are reduced to, respectively, tendency to longitudinal motion and rotation of the very smallest pieces of matter. These explanations of light have come to be seen as archetypal for Descartes's treatment of natural phenomena.[2] Given his commitment to

[1] A version of this chapter was originally published in *The Philosophical Quarterly* 65/261 (2015): 669–689.

[2] The propagation of light tends to be the key example in scholarship on Descartes's use of analogy in natural

the unity of the sciences, it makes sense to presume that Descartes explains all aspects of the natural world, including physiology, in the same way, such that what goes for light also goes for the living body.[3] Thus, Clarke tells us that 'Descartes's whole scientific project is one of imaginatively constructing descriptions of the motions of particles which might explain natural phenomena' (1982: 124); in a recent paper, Theurer asserts that Descartes's aim is 'to explain all of human physiology in terms of the principles of Cartesian physics. Ideally, all of this could be explained in terms of the properties of fundamental particles' (2013: 912–3). This position is echoed in both Hatfield (1992: 340) and (in a more restricted context) Hatfield (2000: 635), while Fuchs (2001) sees Descartes's aim in physiology as being 'to explain vegetative-vital processes exclusively in terms of [the] lowest level' (2001: 123), which involves reducing the 'vital heat' provided by the heart to nothing more than 'an exothermic reaction of particles' (2001: 115). It is symptomatic of this approach that Smith (2006b: 14; 2006a: 88) sees Descartes's inability to account for embryogenesis specifically in terms of corpuscular mechanics as a 'failure'.

By contrast, Des Chene (2001) has convincingly shown that there is more to Descartes's treatment of physiology than corpuscles: there are systems too. Similarly, Brown (2012) has argued that Descartes's account of embryogenesis consists of a 'whole matrix of interdependent processes' (2012: 12), which I suspect we may take to suggest something strongly systemic.[4] As Des Chene puts it, for Descartes, 'the body is to be analysed into systems of mechanisms, and each mechanism into simpler mechanisms, until we arrive at mechanisms whose capacities can be understood in terms of the modes and derived properties of extended things' (2001: 154).

I take Des Chene's identification of systems of mechanisms seriously. However, Des Chene sees Descartes as moving away from systems, proceeding through a string of recursive reductions until reaching the level of corpuscular mechanics ('the modes and derived properties of extended things'). This is entirely consistent with Descartes's

philosophy. See, e.g., Clarke (1982: 122ff.), Galison 1984; Manning (2012). The account of colour is often used to exemplify Descartes's reductive method, since it is part of the conclusion of his only extended description of his own use of his method, given in Discourse 8 of the Meteors (see, e.g., Buchwald 2008, Clarke (1982: 173ff.), Garber 2001b, Garber 2001a, Georgescu and Giurgea 2012).

[3] Descartes's most significant statement of commitment to the unity of sciences is of course the simile of the tree of knowledge in the preface to the French edition of the *Principles of Philosophy* (AT IXB: 14–5; CSM I: 186).

[4] On interdependence and systematicity, see §1.3.1.1 below.

ontological commitments, but it is not, I want to argue, the approach that Descartes takes in accounting for the 'principal parts' (*Passions* a. 6) of the body. It is the reduction to the lowest level that I argue against here: instead of reduction to corpuscular mechanics, Descartes explains the operation of the body through whole systems. And the components of those systems exist at different levels. In other words, the systems remain systems; they do not get reduced away to corpuscles.

If my reading is correct, then what goes for light does not in fact go for the living body. As Roux puts it, 'in his biological treatises, Descartes rarely speaks of laws of motion, or even of corpuscles' (2004: 34). If the explanations of light are taken to be archetypal of Cartesian explanation in natural philosophy, then, it means we have misunderstood at least some of Descartes's natural philosophy: his explanations in physiology (and perhaps elsewhere: see §1.3.3). Where the explanations do not reduce to corpuscular mechanics, this is not a 'failure' on Descartes's part, but a property of the kind of explanation in use.

The focus of this chapter is not on Descartes's own claims (in, e.g., the *Principles*) about what he is doing in natural philosophy: my intention is not to recover what Descartes *really meant* when he wrote about explanation. Instead, I am concerned with what Descartes actually *does* when he explains physiology. My ultimate concern here lies with understanding the philosophical implications of Descartes's account of physiology rather than with understanding his intentions (see the introduction, §0.3). Accordingly, in this chapter, I do not attempt to establish whether or not Descartes-the-philosopher would agree with my analysis of the work of Descartes-the-physiologist[5], and I use anachronism where avoiding it would be inefficient.

This is by no means to suggest that the analysis presented here is incompatible with Descartes's philosophy, however. For instance, while Descartes himself does not use the term 'system' in the sense employed here, a passage in La Forge's commentary on the 1664 edition of Descartes's *Traité de l'homme* suggests that something like a systems reading was available in the period: the body-machine is 'composed of many organic parts which, united, work together to produce certain movements of which they would not be capable if they were separated'[6] (La Forge 1664: 173). Nor is my aim to describe a method for Descartes's physiology that is discontinuous with his larger project. I take

[5] See Ch. 6.

[6] '[. . .] *composé de plusieurs parties organiques qui estant unies, s'accordent à produire quelques mouvements, dont elles ne seroient pas capable, si elles etoient separées.*'

it that aspects of systems explanations turn up throughout Descartes's natural philosophy (§1.3.3), and that the unity of the sciences is less at risk if we distinguish between explanatory and ontic systems, and rule out the latter (at least for now) (§1.2.2).

In what follows, §1.2.1 provides a definition of the type of system in question here, in the form of a brief outline of its structure; §1.2.2 makes a distinction between explanatory and ontic systems, favouring the former for the purposes of this reading. The type of explanation outlined in §1.2 is then used in §1.3 to analyse Descartes's explanations of physiology. §1.3.1 focuses on his account of the heartbeat. First, §1.3.1.1 shows how the explanation is systemic and compositional. Next, §1.3.1.2 demonstrates how Descartes's explanations are constructed in terms of the effects and components set out in §1.2.1. The analysis of the explanation of the heartbeat concludes by showing that the components of the system exist at different explanatory levels (§1.3.1.3). Systems explanations are not restricted to the heartbeat and associated systems, which §1.3.2 demonstrates by applying the analysis to explanations of bodily growth and muscular movement, while §1.3.3 assesses the extent which systems explanations, or some of their features, may be present outside the physiology.

1.2 Systems

1.2.1 Definition

I make use of systems explanations here as an analytical tool: the application of this analysis in the rest of the chapter will show how it makes sense of Descartes's explanations of physiology.

An explanation is systemic insofar as it is given in terms of systems – that is, for the purposes of this chapter, aggregations of components[7], organised in such a way as to determine an effect. I refer to the organisation of the components as the system's 'composition', and it is the composition that is the ultimate determinant of the system's

[7] Descartes uses the term 'part' ('*partie*' (AT XI: 225–6, 234, 253) or sometimes '*piece*' (AT XI: 119)). I prefer 'component' here because of its connection to composition and because of its generality (we tend to think of parts as straightforwardly physical, whereas what constitutes a component depends on the system; here, components are activities).

effect.[8] The components are mostly systems themselves. When components are not systemic, they consist of nothing more than the behaviour of individual corpuscles (such as the stochastic movement of spirit-corpuscles in muscles). Non-systemic components are non-systemic because lower-level organisation plays no part in determining their behaviour. All components, both systemic and non-systemic, determine their own effects (e.g., a blood-expansion component determines the effect of blood expansion). As such, all components are activities rather than static (anatomical) structures: they are things that happen and, in doing so, determine other things to happen.

These explanations involve multiple levels when the components of the system exist at different levels: within the explanation, lower-level components have direct causal and dependency relations with higher-level components, and vice versa. The levels distinction relevant here is not between visible and subvisible (as in, e.g., Galison 1984) but between levels of organisation (the engine of a car is at a lower level than the car itself, but at a higher level than the pistons). There are multiple ways to hierarchise such levels, but doing so with precision is not necessary for the argument here, which requires only a distinction between the lowest level and some higher level(s): where there are causal or dependency relations between any higher and any lower level, the system is multilevel.

1.2.2 Explanatory versus ontic systems

On the face of it, appeals to whole systems and multiple levels within them ought to be a serious problem for Descartes. His metaphysics commits him to an ontology of the natural world that cannot involve more than the shape, size and motion of pieces of extended substance. If he is invoking system properties and higher levels in preference to the behaviour of corpuscles, he appears to be in trouble. One way of dealing with this inconsistency would be to surmise that (A) Descartes's philosophical project is simply not as coherent as he wanted it to be. On reaching the outer branches of his tree of knowledge, perhaps he faltered, and perhaps things became somewhat messier

[8] See Shapiro (2003: 435): '[w]hat makes a machine the machine it is [. . .] is its particular composition'. And Gaukroger (2002: 393): 'Descartes wants to subordinate function to structure'.

than they had been within the solid roots of metaphysics. This is possible.[9] On this reading, if Descartes does include systems of the kind described here in his physiology, they are ontic systems: they exist in the real, material world. In that case, he would be (presumably inadvertently) giving up on his ontological parsimony and tacitly accepting the existence of hearts and lungs as real entities in the world (or, rather, heart-beating and respiration as real activities in the world).

We can, however, find such systems in Descartes's physiology without breaking so radically from his metaphysical commitments if (B) the systems are explanations only.[10] On this reading, they are not ontic systems. Descartes does have ontic *mechanisms*, but they can exist only at the lowest level (i.e. the corpuscle level). Heart-beating, respiration, and blood-expansion get to be components of an explanatory system, but Cartesian ontic mechanisms are composed of corpuscle-behaviour alone. This means that, in a Cartesian world, systems with components on higher levels can never be isomorphic to ontic mechanisms. In addition, systems explanations cannot be direct descriptions of ontic mechanisms[11], because systems include components that are not available to Cartesian ontic mechanisms. Because systems explanations cannot directly describe real-world mechanisms, the explanations may be hypothetical, or heuristic, or they may 'overlay' real-world mechanisms.[12] My position is compatible with all three options. In the case of overlaying explanations, systems explanations would describe real-world mechanisms, but only indirectly, just because the components of the explanatory systems would bottom out at different levels from the components of the real-world mechanisms.

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[9] Machamer and McGuire (2009) suggest that inconsistency is the appropriate way to interpret the relation between Descartes's earlier and later work. They do not, however, uphold the kind of incoherence between Descartes's later metaphysics and physiology that (A) entails. I am grateful to an anonymous referee for pointing out the relevance of Machamer and McGuire here.

[10] The 'how-possible' reading of Descartes's physiology given by Des Chene (2005) might lie somewhere between the incoherence and explanatory-systems readings. In the context of that interpretation, Descartes's how-possible explanations would be systemic rather than strictly reductionist.

[11] Recent work on mechanism sees (modern) biological mechanistic explanation precisely as description of real-world mechanisms (Machamer, Darden and Craver 2000: 3). It is a difference in ontology that allows for the difference in possibility of describing real-world mechanisms.

[12] On hypothetical explanation in Descartes's natural philosophy, see in particular Clarke (1982: 133ff.) and Manning 2012.

There is an argument to be made for (A), and the analysis in this chapter would be broadly compatible with that position. Nevertheless, I have assumed (B) here, partly because it is the less revisionist path, and partly because it avoids problems that may be generated by conflating explanation with ontology (the chapter remains agnostic about whether or not the explanatory systems overlay real-world mechanisms).

There might also be a case to be made for (C) an ontic reading of Cartesian systems that maintains the coherence of Descartes's project. While an ontic reading might seem entirely at odds with Descartes's ontology, perhaps allowing an ontological status to systems is not significantly more problematic than allowing it to corpuscles in a world of extended substance.[13] This is potentially interesting, but making the case for it would be an undertaking lengthy enough to hijack the thesis of the present chapter. Consequently, I leave (C) to be addressed elsewhere. If my analysis in the chapter is correct, however, and if (C) does indeed hold, then we will be able to say that Descartes's ontology contains real multilevel systems.

1.3 Systems in Descartes's physiology

1.3.1 The heartbeat

The following section analyses Descartes's most extensive account of the heartbeat in terms of systems. The account comes from Descartes's *Description of the Human Body* (hereafter, *Description*), a late manuscript that integrates and expands on his prior work on physiology. The analysis shows that the explanation of the heartbeat involves considerably more than corpuscular mechanics (as defined in §1.1), first in terms of its systematicity and composition, then its effects and components, and finally its reliance on appeal to multiple explanatory levels.

1.3.1.1 Systematicity and composition

For the purposes of this chapter, a system is an aggregation of components, organised in such a way as to determine an effect (§1.2.1). Consequently, if Descartes's explanations are given in terms of components whose organisation determines a

[13] My position in the published version of this chapter was that there might be some support for an ontic account to be found in Descartes's remarks on the real distinction in the *Principles* (1/60) (*Cf.* Sowaal 2004). Within the framework established in the second part of this dissertation, I would say that the unity of any physical body might be another irreducible. See Ch. 6, §6.3.3, p. 152 below. *Cf.* Lennon 1994 and 2007, and the discussion of the latter in Ch. 6, p. 140 below.

particular effect, we can say that they are systemic. The second part of the *Description* is concerned with explaining the effect of the heartbeat (along with the effect of heat generation). While it begins with the movement of the heart itself, the complexity of the account escalates rapidly. It soon reaches the point where it is no longer limited to the activity of the heart alone. It extends inexorably first to the haematic circulatory system, then to the respiratory system, and then (in part three) to nutrition and assimilation (AT XI: 231f). The explanation of the heartbeat continues throughout: it is not that Descartes explains the heartbeat and then moves on to another physiological effect; rather, he explains the heartbeat *by* moving on. The explanation of the heartbeat requires the explanation of circulation, respiration, and so on. We see this in a nutshell when the explanation moves from the heart itself to circulation:

> by these means [the blood in the arteries] swells and rises at the same time as the heart; and it is this movement, *as much of the heart as of the arteries*, that is called the pulse
>
> (DHB: 5; AT XI: 232; my emphasis).

Clearly, Descartes does not see the heart and the circulatory system as independent entities. The movement of the pulse pertains as much to the heart as to the arteries. This implies that a change to the arteries, or to their relations with the heart, would mean a change in the movement that constitutes the heartbeat-effect. In other words, organisation (the composition of the system) must be playing a part in determining the effect here.

The case for the role of organisation grows stronger as the account continues. Descartes goes on to show how, just as the pulse depends on the heartbeat, the heartbeat depends on the pulse, via the circulation. This is because the reentry of the blood into the heart is a partial cause of the next heartbeat (see §1.3.1.2). Thus, the heartbeat is dependent on circulation, and circulation is dependent on the heartbeat. Following the movement of blood through the circulation, the account naturally takes in the pulmonary blood vessels (AT XI: 235f.). And then it turns to the lungs, concluding that,

> the main use of the lung consists in one thing alone: by means of the respiratory air, it thickens and tempers the blood that comes from the right ventricle of the heart before it enters the left ventricle; *without this it would be too rare and too fine to serve to fuel the fire that it encounters there*
>
> (DHB: 177; AT XI: 236; my emphasis).

The *Description*'s account of the heartbeat does not – and seemingly cannot – keep these bodily systems isolated. As soon as the heartbeat is brought up, the circulation of the blood follows necessarily. And then respiration follows too. And it does not merely *follow*, because without the thickening of blood during respiration, there would be no heartbeat: respiration is indispensable for the process that explains the beating of the heart (and its warmth). It turns out that Descartes cannot give an account of the heartbeat without also referring to and relying on everything involved in respiration and circulation. Each plays a necessary role in explaining how the heartbeat works: in the absence of circulation or respiration, there would be no heartbeat. And each plays its role within a specific organisation: if respiration did not precede the entry of blood into the left ventricle, the blood would be 'too rare and too fine' for the process to continue; if circulation did not follow the active phase of the heartbeat, there would be no blood to re-enter the heart. Each must occur in a particular order for the heartbeat-effect to be produced.

The heartbeat, circulation, and respiration do not constitute, however, the extent of Descartes's explanation. The next section of the *Description* deals with the nutrition of the body's organs, which is a consequence of the circulation of the blood (AT XI: 245f.). But nutrition results in the loss of corpuscles from the blood (AT XI: 246). Thus, the explanation has to include assimilation as well. Otherwise, the supply of blood on which the heartbeat, circulation and nutrition depend would dry up. At the same time, assimilation depends on both the flow of blood provided by the heartbeat and circulation, and on the organ-integrity provided by nutrition. From the heartbeat, the circulation of the blood follows. And the nutrition of the organs follows the circulation. And assimilation follows nutrition. Simultaneously, each is dependent on the others. What started as an account of the heartbeat now encompasses the whole of the body. Each of the major parts of the body depends immediately on at least some of the others, which in turn depend on others, *and* on the original part in question. Ultimately, each part ends up depending on the whole system. At the same time, the system must depend on its component subsystems:

> in considering only the exterior of the human body, we never imagined that it had enough organs or springs in it to move itself in all the different ways in which we see it move
>
> (DHB: 170; AT XI: 224).

Descartes's point is that, although they are not visible, the body does indeed (and must) contain all the organs and 'springs' it needs to operate. And when 'one of the principal parts of the body decays' (Passions a. 6; CSM I: 329; AT XI: 330), the whole body dies,

and its systems cease to function.[14] That is, the system of the body as a whole depends on its component subsystems, and their organisation, to such an extent that the failure of any one of them results in the failure of the whole.

The system of the principal parts of the body is thus not simply a chain of dependencies: it is not just the case that the heartbeat must follow respiration; respiration must also follow the heartbeat. Without the one, there would not be the other, and, crucially, vice versa. Most of all, it is the circularity that makes the dependencies here more than a simple chain. The movement of a billiard ball can be dependent on the movement of the ball that struck it, whose movement can in turn be dependent on the ball that struck it, and so on: that would constitute a chain. But a self-perpetuating system in which each component is simultaneously dependent on each of the others and on the system as a whole is a different matter. Descartes's explanation of the heartbeat looks like the latter rather than the former. As such, the dependencies are circular, and the system is intradependent: its subsystems are reciprocally dependent on each other. A failure in any one of them also results in the failure of each of the others (if the respiratory system stops working, the heart stops beating, and vice versa). And there is good reason to think that Descartes is quite aware of this, given that, after having established the dependencies between various functions involved, he describes the circulation and heartbeat as forming a 'perpetual circular motion' (DHB: 179; AT XI: 239): without the dependencies between functions, there would be no motion of the blood, and without the circularity of those dependencies, the motion would not be circular (blood would end up spraying out somewhere, and the body would die).

Brown (2012) recognises a similar interdependence of subsystems in Descartes's embryology, in which organs develop through accretion of particles deposited by a stream of fluid that flows along a circular path, such that 'the formation of the brain is necessary for the persistence of the heart and the formation of the heart a necessary precondition for the formation of the brain' (2012: 12). Brown points out that what is special about the interdependence in Descartes's account of embryogenesis is that – unlike the metaphysical dependence of every piece of extended substance on every other piece – embryogenesis is not 'indifferent to the way in which matter is arranged' (2012: 13). In other words, the organisation is integral in determining the effect: the interdependence of physiological subsystems makes for a strong form of

[14] Descartes does not list what he takes the principal parts to be, but, as the analysis here shows, they must include at least the heart and the circulatory, respiratory, and digestive systems – when any of those fails, the others cannot continue to work, and the body ceases to operate.

systematicity. What we see when we look at the account of the heartbeat is that interdependence goes beyond development. For Descartes, the parts of the living body are in a continuous and perpetual state of interdependence, and the body itself is therefore strongly systematic for as long as it is alive.

The interdependence here is a strong case; it is not the sole determiner of systematicity. For some of the body's subsystems, the dependency is clearly one-way: muscular movement or hearing both depend on the whole body, but not vice versa. Aside from the possibility of internal interdependence in muscular movement and hearing systems, these cases still fulfil the minimum condition for systematicity given in §1.2.1 (a particular organisation of components (of some kind) that determines a particular effect).

So far, everything in the explanation has taken place at a high level (heartbeat, circulation, respiration, etc.); the following section moves the analysis to a lower level of organisation: what, on Descartes's account, happens inside the heart. It finds the components involved in the explanation, and shows how, through their organisation, they determine the effects of the system.

1.3.1.2 Effects, components and activities

Systems, like bodies, are made up of parts, which I refer to here as 'components'. The obvious place to look for the components of Descartes's physiological systems is in the anatomical structures of the body: hearts and lungs and so on. However, in what follows, I argue that we can make better sense of Descartes's systemic explanations if we do not take the components to be anatomical. On the reading presented here, the components are activities instead: heart-beating and respiration, rather than hearts and lungs. We saw an instance of this in the last section, in Descartes's recognition that the pulse is a movement continuous throughout various anatomical structures, and not localisable to any particular one. The activities that Descartes invokes are often motions (colliding, falling, etc.), but they need not be: they could also be, e.g., resistance, or tendency to motion.

The main section of the *Description*, titled 'on the motion of the heart and blood', does begin with anatomy. Here, though, anatomy is only background knowledge for the explanation of the heartbeat and circulation. As such, it is necessary both for constructing and for understanding the explanation, but it is not part of the explanation itself. The introduction to the *Description* claims that the text requires only

minimal knowledge of anatomy, and that anything beyond the very basics will be introduced when necessary (AT XI: 226). Echoing the earlier *Discourse* (AT VI: 47), Descartes asks the reader to obtain and dissect 'the heart of some land animal, something reasonably large (for they are more or less similar to those of men)'. We are then expected to follow along with the dissection while he briefly describes the heart's gross anatomy (DHB: 172–4; AT XI: 228–31). That this is background knowledge is made explicit when Descartes segues into the explanation proper:

> When the anatomy of the heart is seen in this way, if one considers that it always has more heat in it when the animal is alive than any other part of the body, and that the blood is of such a nature that when it is a little hotter than usual it expands very quickly, *one cannot doubt that the movement of the heart, and following it the pulse, or the beating of the arteries, occurs in the way that I shall describe*
>
> (DHB: 174; AT XI: 231; my emphasis).

Descartes lists three items of knowledge necessary for his explanation but not part of it: cardiac anatomy, the heart's greater warmth relative to the rest of the body, and the propensity of blood to expand at low temperatures. (We should presumably add the principles of his physics as a tacit fourth.) His point here is that, in light of these three items, the heartbeat and circulation must work in just the way he is about to describe. This implies two things: that the explanation is yet to begin, and that anatomy is not a component of the explanation – i.e. that it is background knowledge.

At first sight, it seems surprising that the anatomy of the heart should not play a role in an explanation of the heartbeat. But (per §1.2.1), components are activities. And seeing components as activities makes sense of Descartes's treatment of anatomy: a dissected heart is inactive – or 'deflated (as it always is when animals are dead)' (DHB: 173; AT XI: 229) – and the features of an inactive heart do not themselves explain the active beating of the heart.[15] Consequently, the anatomical features of the heart are not components in Descartes's explanatory system. It is only when Descartes begins to describe a system of active components (making use of the background knowledge of anatomy) that he begins to explain the heartbeat (and the circulation). This much is consistent with his explanations of physical phenomena outside of physiology: it is the tendency to motion of particles that carries the weight in explaining light propagation, for instance, rather than the particles themselves. In the terms we are using here, tendency

[15] A dissected heart is not *necessarily* inactive for Descartes. In his correspondence with Plempius, he cites two experiments on fish hearts 'which, after they have been cut out, go on beating [. . .]' (CSMK: 80; AT I: 523). In this case, although dissected, they are still active hearts. It is still the activity that is relevant. See to Plempius, 15 February 1638 (AT I: 523) and 23 March 1638 (AT II: 66f.).

to motion would constitute an activity.

The explanation proceeds as follows:

> [w]hen the heart is *elongated* and *deflated*, there is no blood in its ventricles, except for a small amount which *remains* from that which has previously been *rarefied*. This is why two large drops *enter* them there, one *falling* from the vena cava into its right ventricle, and the other *falling* from the pulmonary vein into the left one, and the small amount of *rarefied* blood that remains in these ventricles, *mixing* straightaway with the fresh blood *coming in*, is like a kind of yeast, which *causes* it to *heat* and *expand* immediately, and by these means the heart *swells*, *hardens*, and *becomes a little squatter in shape* [. . .]
>
> (DHB: 174; AT XI: 231; my emphases).

This short passage alone makes use of activities of elongation, deflation, remaining, rarefaction, entering, falling, mixing, causing, heating, expanding, swelling, hardening and becoming 'a little squatter in shape'. These are the components in the account. They are what Descartes uses to construct the explanation. Drops of blood enter and fall into the ventricles. There, they mix with previously rarefied blood, which acts 'like a kind of yeast [*levain*]'. This causes the new blood to heat up and expand. As a result, the heart 'swells, hardens, and becomes a little squatter in shape'. At the same time, the membranes between the vena cava and the right ventricle, and between the pulmonary vein and the left ventricle are forced closed (like valves). This prevents the blood from exiting the ventricle the way it entered. Instead, it escapes through the pulmonary artery and the aorta, from the right and left ventricles respectively (AT XI: 232).

Anatomy in itself is not directly explanatory within the account, but it is not entirely absent either. Where it is invoked, it is subordinated to the activity. The vena cava comes into the explanation only as the place from which blood enters. Similarly, the ventricles are the place where new blood falls and mixes with the rarefied blood, and where that rarefied blood has remained after the active phase of the heartbeat. The ventricles are also present in the account via the constraining activity that conspires with the rarefaction of the blood to determine its exit through the arteries (AT XI: 232). In the same way, the blood is not portrayed here as simply a fluid being pumped through the heart. It is active throughout the account. The falling of fresh blood into the heart and its mixing with the remaining rarefied blood (partly) determines its expansion. And the expansion itself is, for Descartes, the activity that inflates the heart. Even the rarefied blood that remains in the ventricles does not sit there

passively: Descartes explicitly describes it in active terms: as causing the fresh blood to expand when they mix.

So, the components in the explanation are activities. And it is their activity that gives them their explanatory power: the heart's deflating *does* something, and what it does contributes to what the whole system does. But, that is not to say that the activity of the system reduces down to what its components do. Any component isolated from the system's composition would contribute nothing to the activity of the system. It is the composition, and not the constituent components, that determines the system's effect. Thus, rarefying blood would simply expand uselessly if it were not within a ventricle too small to keep it contained, with valves that open to let it flow out, etc. But, when rarefying blood is taken along with heart deflation and the other components of the system, in the right composition, we get the heartbeat.

So far, the components involved in the explanation have all been at a fairly high level. Even an activity as simple as the falling of blood is at a clearly higher level than corpuscles (since talk about blood behaviour is not talk about corpuscle behaviour). As it stands, the explanation is clearly not a reduction all the way down to corpuscular mechanics: corpuscles have not even entered into it at this point. We still need to establish whether the explanation ever reaches down to corpuscles. The next section looks at a corpuscle-level account of blood expansion in the heart, and then shows how Descartes has to integrate it with plainly higher-level components in order to construct an explanation of the heartbeat.

1.3.1.3 Multilevel explanation

The section of the *Description* that deals with the motion of the heart and blood provides no explanation of the initial cause of the blood's expansion. What it does offer is an analogy in which the blood acts like yeast (AT XI: 231). But it does not explain the mechanism that causes the yeast-like activity. For that explanation, we need to look at an account later in the *Description*, in the section on embryogenesis:

> when most of the blood leaves the heart at the time of diastole, those of its particles which remain there enter into the flesh, where they find pores disposed in such a way, and fibres agitated in such a way, that there is only matter of the first element surrounding them; and at systole these pores change shape because the heart lengthens, which makes the particles of blood, which remained there as if they were to serve as yeast, leave there with a great speed, and in this way entering

> easily into the new blood coming into the heart, they make its particles separate from one another, and in separating thus they acquire the form of fire
>
> (DHB: 203; AT XI: 281f.; translation adjusted).

The yeast allusion reappears in this passage, but this time gets accounted for down to the corpuscle (particle) level. In this case, the 'yeast' activity is explained by the ejection of corpuscles of blood from pores in the heart wall. These corpuscles hit the new blood concurrently entering the heart. The yeast-acting blood corpuscles move at such speed that collision with the corpuscles of the new blood makes the latter move significantly further and faster. The result of this is that the blood both heats up and expands. As in the account covered in §1.3.1.2, once the blood has expanded and most of it has forced its way into the arteries under its own pressure, a small amount remains in the ventricles. Descartes now specifies that what remains sinks into pores in the heart wall. The rarefied blood stays there until the heart enters systole (its passive phase for Descartes) and relaxes. In relaxing, the heart lengthens, compressing its walls relative to their state when the heart was 'a little squatter' during diastole. This compression of the walls is also a compression of the pores within them. The result of this is to force the yeast-acting blood out into the new blood that is in the process of entering. At this point, the active phase begins again, and the whole process of the heartbeat repeats.

A fairly obvious objection arises at this point. Since the passage above shows that Descartes has an explanation of blood expansion in terms of corpuscles, perhaps the account of the heartbeat might simply be straightforward Cartesian reduction to corpuscular mechanics, and not a multilevel system after all. However, this relies on mistaking a (partial) appeal to the behaviour of corpuscles for a full reduction of the phenomenon to the corpuscular level. In the account above, corpuscles are invoked for only part of the explanation. There are three components at the corpuscular level: (1) blood corpuscles moving at high speed, (2) blood corpuscle collisions and (3) increased mean blood corpuscle movement as a result of (2). (There are also the corpuscles of the first element (the smallest of Descartes's three elements), although their role is fairly obscure in this particular account.[16]) At most, this can count as a reduction of blood heating (and, indirectly, blood expansion, because increased mean blood corpuscle movement leads to expansion as well as heat) to the corpuscular level. But the effect in

[16] There are strong parallels between this account and the explanation of fermentation in damp hay in *Principles* 4:92. There, corpuscles of the first element accelerate corpuscles of grass sap, ultimately causing heat, under certain conditions. Similarly, a little earlier in the *Description*, Descartes discusses the origin of heat in the developing foetus in terms of matter of the second element agitated by matter of the first (AT XI: 281).

question is the heartbeat, and the corpuscle level here certainly does not provide enough to explain how the heart beats.[17]

Given that the blood-corpuscle behaviour alone is not enough to explain the heartbeat-effect, we need to consider the other components Descartes invokes in the account above. If we look at what he actually appeals to, rather than concentrating on the corpuscles, we see a rather different picture of explanation from the corpuscular-mechanics approach. The corpuscle-talk is integrated with appeals to higher levels throughout. The remaining blood corpuscles enter into the 'flesh' of the heart, which is (at least partially) described in terms of pores and fibres. Pores and fibres are not corpuscle-level descriptions. They presumably could be reduced to corpuscles, in principle. But that is not the level to which Descartes appeals here: the interaction of blood corpuscles with the heart wall is not explained in terms of corpuscular mechanics. Most notably, the movement of the yeast-acting blood corpuscles in the account is caused by the relaxation/lengthening of the heart (via the resultant contraction of the pores). If the heartbeat-effect is the highest level in this explanation, and the blood corpuscles the lowest, then heart-lengthening is surely somewhere in between (and presumably closer to the top). So, it is the speed of the movement of the yeast-acting blood corpuscles that allows them to impart movement to the corpuscles of new blood and thus cause heating and expansion. But, it is the higher-level lengthening of the heart that causes the movement of the yeast-acting corpuscles. As such, the explanation is incomplete if it is left at the corpuscle level: the corpuscle-level activity is explained by means of a higher-level activity.

In fact, the explanation is still not complete even with the integration of blood corpuscle behaviour and heart-lengthening. It is incomplete because it does not yet explain the heartbeat effect. An explanation of the heartbeat that goes down to the corpuscle level will need to integrate (1) the account discussed in this section of this chapter with (2) the higher-level explanation discussed in the previous two sections. (1) explicitly explains only the production of heat in the heart. Implicitly, it also explains blood expansion. But it does not explain the heartbeat. Explaining the effect requires appealing to (at least) the following features of (2): the swelling of the heart, the restriction of space for the expanding blood in the ventricles, the valve operation at the entrance and exit blood vessels, circulation and respiration (and probably also nutrition and assimilation). Thus, the account does not explain the heartbeat without appealing

[17] In the *Rules*, Descartes characterises reduction as comprising both an analytic and a synthetic step (AT x: 379–87). What can be synthesised from the terms in use here (the corpuscle behaviour) is blood heating/expansion rather than the heartbeat.

to multiple levels. The corpuscle level is required to explain the expansion of the blood – but the explanation requires appealing to the higher-level interactions with the pores and fibres of the heart wall and (especially) to the higher-level lengthening of the heart. At the same time, higher levels explain the swelling of the heart, and the restriction that causes it and forces the blood out. But they do so only alongside the explanation of blood expansion. All these levels are necessary for the account to explain the heartbeat.

The natural objection now is to point out that, in principle, the whole account *could* be translated into the corpuscular level, even if Descartes chose not to. The problem with this is that it conflates explanatory reduction with ontological reduction. In principle, Descartes ought to be able to reduce the relaxation and lengthening of the heart to corpuscular mechanics, given his metaphysics (i.e. the physical world is nothing but extended substance differentiated by movement). That is, ontological reduction should always be a possibility in the Cartesian world. But, when the goal is an explanation of the heartbeat, a description of heart-lengthening in terms of corpuscles would just miss the point. The question here is one of relevance to the explanation. In other words, it is a question of what plays an explanatory role. Heart-lengthening is necessary for explaining the movement of the yeast-acting blood corpuscles. As such, it plays an explanatory role. Now, heart-lengthening could indeed be reduced to the corpuscle level. Doing so would require an account of the structure, behaviour and interactions of the corpuscles that make up the heart wall. It would also require a similar account of the corpuscles that make up any other parts of the heart's anatomy that move when the heart lengthens, since they would all be involved in corpuscle-to-corpuscle interactions in the process of heart-lengthening. Because this would be a corpuscle-level explanation (and thus non-systemic), we would not need to account for every single corpuscle. But we would need to account for every corpuscle behaviour that, in aggregate, composes heart-lengthening.

If Descartes's aim were to explain heart-lengthening itself, or some other higher-level elastic effect, the corpuscle-talk might fulfil an explanatory role. But given that the aim is to explain the heart*beat*, it is not at all clear that anything would be gained by invoking low-level corpuscle behaviour in preference to high-level heart-lengthening. Worse, doing so risks obscuring the relevant component of the explanatory system (heart-lengthening) beneath the profusion of corpuscle talk. The situation is analogous to attempting to explain the operation of a mechanical clock by appealing to the interactions of the molecules, atoms, or subatomic particles (or, for that matter, corpuscles) that make up the material of the cogs: if you were to ask me how a clock

works, and I were to respond by talking about quantum probability clouds, you would rightly accuse me of answering a different question. My response would have been, intuitively, below a relevance threshold for an explanation of the operation of a clock. In the same way, for Descartes to reduce heart-lengthening to the corpuscle level would be to answer a different question from that of how the heartbeat works. It is in this sense that higher-level heart-lengthening is relevant to the explanation while the corpuscle behaviour is not.[18] Even if Descartes may *claim* elsewhere that explanation should be in terms of corpuscular mechanics, when he explains the heartbeat, he pays attention to a relevance threshold. As such, he selects components from different levels, on the basis of their relevance to the explanation.

Another version of this objection might be to point out that the heart (along with everything else in the material world for Descartes) originally developed from nothing more than the activity of individual corpuscles. That is, that whatever complex systems might exist in living bodies were ultimately formed by corpuscles knocking into each other. But, similarly, an account of the development of the heart would be an answer to a different question: 'where did the heart come from?', rather than 'how does the heart work?'. If Descartes started to explain how the heart works by appealing to corpuscle collisions in his cosmological vortices, we would justifiably accuse him of missing the point of the question.

There is good evidence, then, for concluding that Descartes *does* appeal to multiple levels in his explanation of the heartbeat. He appeals to the higher-level activity of heart-lengthening, for example, when he discusses the production of heat and the expansion of blood in terms of (low-level) corpuscular mechanics. But there are also good reasons to go further and claim that multilevelness in systems provides Descartes with *better* explanations (in at least some circumstances in physiology) than the strict reduction he is supposed to employ. That is, strict adherence to single-level reduction would obscure the higher-level components that play central roles in the explanation. Thus, Descartes's strategy is not to pursue reduction down to lowest-level explanation. Instead, he picks and chooses the more relevant components for his explanatory system from amongst multiple explanatory levels.

[18] My point here is similar to the discussion of bottoming-out in §5.1 of 2000: '[b]ottoming out is relative [. . .] The explanation comes to an end, and description of lower-level mechanisms would be irrelevant' (Machamer et al. 2000: 13).

1.3.2 More systems: muscular movement and nutrition

The *Description*'s explanation of the heartbeat and circulation is not the only system in Descartes's physiology. We can see the same structure of explanation in the account of muscular movement in *The Passions*. The account appeals to the corpuscles that make up the animal spirits. But the spirit corpuscles are only components in a larger explanatory system. On this account, a muscle contracts and lengthens because it contains a large quantity of very small corpuscles which move 'very quickly, sometimes merely eddying in the place where they are located [. . .], and sometimes flowing into the opposed muscle' (a. 11; CSM 1: 332; AT XI: 366). The spirit corpuscles move in much the same way as the corpuscles of rarefied blood in the account of the heartbeat. Through this movement, the muscle containing the spirit corpuscles becomes swollen. As a result of the swelling, it contracts, and thus pulls, giving us muscular movement. But the behaviour of individual particles alone does not determine the movement of the muscle. In addition, the explanation of muscular movement requires appeal to the following higher-level components: the space restriction of the muscle itself (in the same way as the heartbeat requires the space restriction of the ventricles), the opposition of a pair of muscles, and some means to control which muscle contains the majority of the spirits (*Passions* a. 11). It is this entire system, with its particular composition, that forms the explanation of muscular movement.

We can find similar use of systems explanation in the much earlier *Treatise on Man* (written 1632–3). Its explanation of nutrition is one such case. It appeals to the collision of blood corpuscles with the 'roots' of organs, which originate from 'the extremities of the little branches' of the arteries. As the blood flows through the arteries, the pressure of the pulse following the active phase of the heartbeat forces some blood corpuscles into contact with the organ roots. The blood corpuscles push the organ root corpuscles 'in front of them a little, and in this way gradually replace them'. But this alone is not what causes nutrition for Descartes. You get nutrition when new blood corpuscles are left attached to organ roots. And this is explained by appeal to a higher-level component: 'at the moment when the arteries deflate, each of these parts is stopped in its place, and this alone means it is joined to those it touches' (TM: 103; AT XI: 126). Higher-level artery deflation is what causes blood corpuscles to remain attached to the organ roots with which they had collided, and thus to provide them with nutrition. In this case, the activity of the corpuscles is necessary to explain nutrition. But it is not sufficient for the explanation, because the system also requires appeal to artery deflation, on a higher explanatory level, within the context of a composition that determines the effect of nutrition. As such, this explanation too consists not of

corpuscle behaviour alone but of a composed system comprising components on separate levels, with explanatory appeals made between levels.

Of course, Descartes also gives some accounts that straightforwardly seem to keep to a single explanatory level – *Man*'s treatment of digestion, for instance (AT XI: 121). This is to be expected: sometimes the relevancy criterion bottoms and tops out at the corpuscle level, and some effects may be explicable in terms of corpuscle behaviour alone, without the latter's being placed within the context of a system. However, as the previous sections have shown, corpuscular mechanics is far from being the only means of explanation in Descartes's physiology: it is in terms of systems that Descartes explains (amongst other things) what he takes to be the most central function of the body – the heartbeat – where most is at stake (AT XI: 245).

1.3.3 Systems beyond physiology[19]

So far, I have maintained a simplified distinction between Descartes's explanations in physiology and his explanations elsewhere: physiology involves systems, while corpuscular mechanics suffices for physics. In truth, that distinction is not quite so straightforward. Descartes's cosmological vortices certainly look like complex systems. In his optics, he appeals to higher levels alongside corpuscles: reflection and refraction are explained through the motion of balls (analogous to corpuscles, i.e. low-level) thrown, respectively, against the ground and into water (both higher-level) (AT VI: 93–101). I have focused on physiology here because physiology seems to be where the disparity between corpuscular mechanics and the explanations Descartes actually uses is the most noticeable.

But that is not to say that systems explanations, or some features of systems explanation, are not present elsewhere in Descartes's natural philosophy. At the very least, I suspect Descartes frequently finds that appealing to higher levels produces better (i.e. more explanatorily relevant) explanations throughout natural philosophy than could be provided by pure corpuscular mechanics. He may well find the same for systematicity in some cases, although perhaps to a more limited degree than in physiology. The account of vortices, for example, would probably be closer to what Haugeland (1978: 216) calls a 'morphological explanation', in which the effect is the product of the aggregate activity of many parts but is indifferent to their organisation: if you completely rearrange the parts of a vortex, you still have a functioning vortex;

[19] I am grateful to an anonymous reviewer both for raising the concerns addressed in the following section and for suggesting relevant examples.

the same cannot be said of a living body. Regardless, to whatever extent Descartes's explanations elsewhere look like the systems discussed here, the conclusions of this chapter will be (partially) applicable throughout his natural philosophy.

1.4 Conclusion

Descartes is generally taken to be a strict explanatory reductionist about the natural world. His metaphysical commitments seem to tie him to explanation in terms of corpuscular mechanics: his aim appears to be the reduction of complex observable phenomena to nothing more than the particular behaviour of individual subvisible corpuscles taken in isolation. However, at least some of Descartes's explanations in physiology (and perhaps elsewhere) look nothing like explanations in terms of corpuscular mechanics. Instead, they are systemic, and they appeal to multiple explanatory levels. In these systems, the effects are not determined by the behaviour of individual corpuscles. They are determined by the composition of the whole system. And the components of that system are drawn from different levels, with interlevel causation and dependency relations.

The analysis offered here shows that we misunderstand Descartes's natural philosophy if, as the standard view has it, we take him to pursue reduction to the lowest level in order to provide explanations. It is not only that he does not in fact reduce what he takes to be the principal physiological systems to corpuscular mechanics. Systems explanations are better explanations in some cases, where it is the entire composition that explains the effect (rather than the behaviour of individual corpuscles), and where each component is taken from the level that is explanatorily relevant for that component. Thus, the explanatory power of Descartes's physiology comes not from its reductionism as such, but from its willingness to stop the reduction where appropriate.

Chapter 2

Does Descartes have a principle of life? Hierarchy and interdependence in Descartes's physiology[1]

2.1 Introduction

At various points in his work on physiology and medicine, Descartes refers to a 'principle of life'. The exact term changes – sometimes, it is the 'principle of movement and life' (CSM 1: 108; AT XI: 202), sometimes the 'principle underlying all [the] functions' of the body (CSM 1: 331; AT XI: 333) – but the message seems consistent: the phenomena of living bodies are the product of a single, underlying principle. That principle is generally taken to be cardiac heat.[2] The literature has, quite reasonably, taken this message at face value. Thus, Shapiro: 'Descartes insists again and again that the human body is properly to be described as a machine whose workings are [. . .] *driven by the heat in the heart that is the principle of life*' (2003: 240; my emphasis). In *Le Principe de vie chez Descartes*, Bitbol-Hespériès writes '[t]he principle of life [. . .] is conceived of as the logical initial term, or the fundamental proposition, that accounts

[1] A version of this chapter is forthcoming in *Perspectives on Science*.

[2] See Bitbol-Hespériès (1990) for an extended argument that Descartes's principle of life is cardiac heat. There is, however, some variation in Descartes's discussion of the principle (e.g., 'the souls of animals are nothing but their blood' (to Plempius for Fromondus, 3 October 1637; CSMK 62–3; AT 1, 414)); see §2.4.3 for an analysis of such claims.

for the phenomenon of life'[3] (1990: 25). This reading of Descartes's principle of life as some kind of initial term, or foundation, for his physiology tends to be affirmed either tacitly or explicitly wherever the subject is brought up (e.g., Aucante 2006: 164; Des Chene 2001: 3, 26; Gaukroger 2010: 10–1; Fuchs 2001: 131; Shapiro 2011: 272, 273, 282; Smith 2007: 624).

This chapter challenges that reading of the principle of life. It argues for a distinction between (1) the general claims that Descartes appears to make about the principle of life and (2) the role this ostensible principle has in his physiology. My position is that, when it comes to (2), there is no single underlying principle. In spite of (1), Descartes's account of physiology takes the body to be structured in such a way that it can have no such principle – that is, interdependently rather than hierarchically. The body itself is structured interdependently in that the major bodily systems are dependent on each other, and not on an underlying principle that 'drives' them. At the same time, there can be no single underlying principle even epistemologically: Descartes's account of the living body is structured interdependently too, in that knowledge about physiology depends on knowledge about all the major systems and their interactions, rather than being built up on top of some primary 'initial term'. This means that neither life functions themselves nor our knowledge of them are reducible to a single principle.

My position is that, for Descartes, cardiac heat depends on (at least) circulation, respiration, and digestion (see §2.4.1), all of which themselves reciprocally depend both on cardiac heat and on each other. Brown (2011: 11–13) has previously identified interdependence in Descartes's account of generation (embryogenesis), where '[t]he process by which one organ is formed and operates is not independent of the processes by which others form and operate and this whole matrix of interdependent processes continues until a relatively closed system [. . .] comes into being' (12).[4] Here, I show that interdependence is an ongoing state of the living body for Descartes, and that we can use this to make sense of what would otherwise look like his rather bizarre treatment of the ostensible principle of life (§2.5).

My intention here is not to accuse Descartes of inconsistency. Rather, my aim is to tease out the consequences of Descartes's physiology in order to show that what is going on there is somewhat different from, and perhaps more interesting than, what he

[3] 'Le principe de vie [. . .] est conçu comme terme rationnellement premier, ou proposition fondamentale rendant compte du phénomène vital.'

[4] See §2.4.2 for further discussion of Brown (2012).

appears to claim to be doing.[5] I begin by setting out the reasons for thinking that cardiac heat might indeed be the 'initial term' of the physiology, or the engine that 'drives' it (§2). I then set out Descartes's account(s) of cardiac heat (§3), before giving a constructive reading of his physiology, in which the major bodily functions are shown to be interdependent (§4). Finally, I show how the interdependence reading makes better sense of Descartes's treatment of cardiac heat (§5), and how it obviates the need for any unitary fundamental principle (§6).

2.2 Principles

When Descartes uses the phrase 'principle of life', there are two obvious connotations: (1) 'principle of life' is a standard designation of the soul in the Aristotelian tradition (see §2.1); (2) principles are foundations in Descartes's famously foundational system of knowledge (see §2.2). Since the soul is the source of life for Aristotle, the natural conclusion to draw from (1) is that Descartes's principle is supposed to be the ontic[6] foundation of physiology on his account of the body – that is, the principle of life is what drives the body itself. Similarly, it seems natural to suspect that, given (2), along with certain passages that appear to claim as much, the principle of life is meant to be the epistemic foundation for Descartes's sciences of physiology and medicine.

In the following three subsections, I set out what it would mean for Descartes to have a principle of life in senses (1) and (2), along with reasons for thinking that his principle of life might indeed be the ontic and epistemic foundation of his physiology. I take it that these are misleading ways to think about what Descartes calls the 'principle of life'; they need to be clarified first, in order to show, second, precisely how they mislead.

[5] Whether or not he is fully aware of the interdependence in his physiology, and its implications for his principle of life, is not entirely clear. His readiness to appeal to a principle of life would suggest not, but see §2.4.3 for some evidence to the contrary.

[6] I am not thinking, of course, of the fundamental ontology of extended and thinking substances here, but of 'ontic' in the sense used in more recent philosophy of science (e.g., Machamer, Darden and Craver 2000). In this case, the 'ontic' is concerned with the body itself and what it contains, as opposed to knowledge thereof. We might instead want to think of the ontic principle as the motive principle of the body, but this would obscure the distinction between the principle of the body itself and the principle of our knowledge of the body; it would also exclude the ontic principle from being something more than just the source of motion in the body (see §2.4.2).

2.2.1 The case for an ontic foundation of physiology

When Descartes brings up his principle of life, it is almost always in express contrast to a position of the 'ancients' or of the 'schoolmen' – that life is attributable to the soul. The position he counters takes the soul to be the source of life, and the engine that drives the self-movement of the living body. This makes the soul the ontic foundation of the living body insofar as it makes all life functions ultimately dependent on the soul. On this account, the dependency relations for life are hierarchical and go one-way only: the operations of the living body depend on the soul, while the soul is independent of the operations of the living body.

As Des Chene notes, '[i]n Aristotelian natural philosophy [. . .], the soul [. . .] is the principle of life. For [pre-eminent scholastic] Suárez, this is even a matter of definition' (Des Chene 2001: 30). Descartes, however, wholly rejects this function for the soul. He repeatedly assures us that life-conferring souls are an unnecessary supposition, because the material body by itself is sufficient for life (e.g., AT XI: 202; AT VI: 46; AT XI: 330; AT I: 413–14). Particularly telling is a letter to Regius, where Descartes writes, 'it goes against logic to conceive the *soul* as a genus whose species are the *mind*, the *vegetative power* and the *locomotive power of animals*' (May 1641; CSMK:182; AT III: 371). This is because his ontology gives him a far more restrictive definition of the soul than was available to Aristotelians, since it allows for only two substances: matter and mind. The mind is identical with the soul for Descartes (and is entirely distinct from matter). On this definition, it is mind that is the genus, making the soul nothing but thought. Consequently, the soul cannot take on any life-founding role precisely because life-founding is a not species of thought. Taking the task of animating the body away from the soul allows Descartes to attribute life to animals as much as to humans while still maintaining that it is only humans that get souls.[7]

In the context in which Descartes took himself to be, where life required a soul as the driving force of the body, it would make sense for a physiology that explicitly excludes the psychic to provide its own substitute for the life-conferring soul. Indeed, this appears to be precisely how Descartes employs the term 'principle of life' – in the Aristotelian sense, but with the psychic element swapped for something more Cartesian (despite his protestations about 'departing from the paths' of the 'ancients' (CSM I: 328; AT XI: 327–8)). As T S Hall argues, 'the explanations [Descartes] developed were corpuscularized, nonpsychistic versions of psychistic explanations put

[7] For an animal to have a soul "is unlikely, because there is no reason to believe it of some animals without believing it of all, and many of them such as oysters and sponges are too imperfect for this to be credible" (to Newcastle, 23 November 1646; CSMK: 304; AT IV: 576)

forth earlier by others' (Hall 1970: 63).[8] On this reading, the Aristotelian principle of life would be imported (along with the ontic connotation that there is a principle of life that drives the body) and simply reinterpreted in as a process compatible with Descartes's ontology.

For the Aristotelians, only certain bodies could be alive: bodies with organs, in the right arrangement. The body consists of an organization of matter independent of the soul; what the soul does is confer life by actualizing the potential of that material organization.[9] The basic structure of this understanding of life was not restricted to the Aristotelian position that Descartes explicitly opposed either. Contemporary Paracelsian medical theory attributed *archei* to every organ. Each *archeus* controls its own organ and is (semi-)independent, with some degree of interaction between different organs.[10] This interaction is also a form of organization within the body. But all these *subarchei* are ultimately answerable to a 'master' *archeus*, an 'internal president, curator and rector' (Van Helmont, quoted in Pagel 1982: 98).[11] On Descartes's account, the organization of the organs remains, while the Aristotelian soul and the Paracelsian master *archeus* are both absent. The question is whether he replaces them with a Cartesian principle that fulfills the same role.

If he is to replace them, and if the soul is off-limits, then there is only one other option for a principle of life in Descartes's dualistic ontology: it must reside in matter. Descartes is committed to a material world that operates mechanistically – through nothing more than the 'shape, size, position and motion of particles of matter' (CSM 1: 279; AT VIIIa: 314). And he explicitly describes the living body as a machine (AT VI: 56; AT XI: 120; AT XI: 226). As such, an ontic principle of life would be the mechanism that drives that machine. This is precisely what appears to be at stake when Descartes compares the body to a watch in his *Treatise on the Passions of the Soul*:

[8] See also Bitbol-Hespériès (1990), Hatfield (1992: 341), Des Chene (2001: 21), Aucante (2006: 166–79) and Joly (2011: 123); more generally, Rozemond (1998), Ariew (1999). But cf. Lindeboom (1979: 69): "the *feu sans lumière* has nothing to do with the vegetative or the sensitive soul," but "[i]n the *chaleur* of the heart which heats the blood, the old Aristotelian innate heat (*calor innatus*) is easily recognized"; if it's not one thing, it's another.

[9] See Des Chene (2000b: 81ff., 112).

[10] See Clericuzio (2012: 331).

[11] I am grateful to an anonymous reviewer for pointing out the relevance of the Paracelsian position here.

> the difference between the body of a living man and that of a dead man is just like the difference between, on the one hand, a watch or other automaton (that is, a self-moving machine) when it is wound up and contains in itself the corporeal principle of the movements for which it is designed, together with everything else required for its operation; and, on the other hand, the same watch or machine when it is broken and the principle of its movement ceases to be active
>
> (*Passions* 1/6; CSM 1: 329–30; AT XI: 330–31).

The analogy seems clear: just as a watch has a principle of movement, a living body has a principle of life; the latter is to the body as the mainspring is to a watch.[12] The passage also makes evident that Descartes equates life with self-movement here (as he also does elsewhere, such as in his letter to Regius of June 1642 (AT III: 566)), since the analogue of the dead body is the watch with the inactive principle of motion. Given that it is self-movement in which Descartes is interested, the ontic principle of life would be the 'spring' mechanism that drives the movements of the machine that is the living body.[13]

2.2.2 The case for an epistemic foundation of physiology

If there is such a thing as the Cartesian principle of life, it seems likely that it is meant to be the ontic motive force within the body. But the significance of principles in Descartes's epistemology is hard to ignore, and there is a certain amount of textual evidence to suggest that Descartes wanted a foundational principle for his physiology. After all, physiology is concerned with living things, and an epistemic principle of life would ground knowledge precisely of living things.[14] Moreover, it is both easy and natural to take Descartes's physiology to be a hierarchical science, with all the knowledge it includes having been built on top of a solid foundation. This is

[12] Note, however, that the analogy refers to more than just the principle – there is also 'everything else required for its operation'. In §2.4, I argue that there is good reason to privilege the "everything else" over the principle. See especially §2.4.3 for an alternative analysis of Descartes's claims about the principle of life.

[13] Even if the ontic principle of life were the body's motive principle, it would be a mistake to take self-movement to be a generalised concept of life for Descartes, since that would not exclude manmade automata (such as watches). The issue of Descartes's general concept of life is discussed in Ch. 3 and Ch. 6, §6.4.

[14] Detlefsen argues that if Descartes had 'no way of isolating a class of bodies taken to be living bodies, [. . .] he would then not be able to identify any individuals to serve as the subject matter of the life sciences—sciences to which he devoted considerable professional time. And this would render incoherent this aspect of his life as a working natural philosopher' (2016: 142).

presumably what Bitbol-Hespériès has in mind when she refers to the principle as the fundamental proposition that accounts for life (Bitbol-Hespériès 1990: 25).

As Descartes claims in the famous letter–preface to the French edition of the *Principles of Philosophy*,

> the whole of philosophy is like a tree. The roots are metaphysics, the trunk is physics, and the branches emerging from the trunk are all the other sciences, which may be reduced to three principle ones, namely medicine, mechanics, and morals
>
> (CSM 1, 186; AT IXb, 14).

The clear implication is that medicine (by which we should also understand physiology[15]) is a hierarchically high-level outgrowth of physics. From the simile, we might expect knowledge of medicine and physiology to be constructed on top of a foundation in physics, just as a branch grows progressively out of a certain point on the trunk.

A few pages earlier in that same preface, Descartes tells us that, in order to do philosophy, we have to begin by looking for basic principles (AT IXb: 2). Since this is a preface to a textbook intended to encompass the whole of the tree of knowledge, 'philosophy' here is unquestionably meant to involve medicine as much as metaphysics.[16] The basic principles form the foundations on which knowledge can be built:

> the knowledge of other things must depend on [these principles], in the sense that the principles must be capable of being known without knowledge of these other matters, but not *vice versa*
>
> (CSM 1: 180–81; AT IXb: 2).

That is, on the hierarchical account, epistemic dependency relations work one-way only. As such, the dependencies reflect the hierarchy: hierarchically higher-level knowledge depends on foundational principles, and emphatically not vice versa.

[15] See p. 46 (§2.2.3) for a little on Descartes's conception of the relation between physiology and medicine. For more, see Aucante (2006).

[16] See Aucante 2006 and Manning's (2007) extended review for thorough and convincing analysis of the position of physiology and medicine within Descartes's philosophy.

Given nothing more than Descartes's general statements about his own epistemic methodology, then, it would make a certain amount of sense to think that something along the following lines is what is going on in Descartes's investigation of physiology. First, it seems as though Descartes should be looking for an epistemically foundational principle.[17] This principle should be taken from his physics, and its purpose would be to bring living bodies within the epistemological grasp of his philosophical system. Once he had such a principle, he could presumably then construct his account of physiology hierarchically, beginning with basic, low-level bodily functions, and then intermediate functions, and then higher functions (presumably, e.g., sensation). These are the presuppositions of an epistemically hierarchical account of physiology, in which knowledge of the living body always reduces to an epistemic foundation.[18] By Descartes' own claimed standards, all this ought to give him good, firm knowledge of the animal/human body. This may well be what he had in mind when he wrote to Mersenne, '[p]lease look after yourself, at least until I know whether it is possible to discover a system of medicine which is founded on infallible demonstrations, which is what I am investigating at present' (January 1630; CSMK: 17; AT 1: 105).

With a hierarchical account of this kind, perhaps it would even make sense for Descartes's explanations of some of the hierarchically higher bodily functions to be somewhat obscure (as indeed they are on occasion), since we could at least be sure that he had the basics right, given that the explanations were derived from a solid foundation. Accordingly, we could expect Descartes's physiology to comprise firm, strong, clear accounts of the more fundamental bodily systems, along with somewhat more flimsy, more obscure descriptions of the higher functions. Crucially, on this reading, we should expect the firmest account to be reserved for the underlying principle – after all, it is the underlying principle that is supposed to confer reliability to the knowledge of physiology (and medicine) that is supposed to be derived from it.

[17] This would be a principle in the second sense discussed by Clarke: '[o]ne sense of "principle" refers to propositions which are guaranteed as certain; the other meaning of the term applies to things the knowledge of which is basic for understanding anything else' (1982: 80–1).

[18] Methodologically, Descartes constructs his physiology through various means: experiments, anatomical observation, incorporation (and modification) of existing explanations, and, arguably, speculation. If his physiology *were* epistemically hierarchical, underpinned by an epistemically foundational principle, reducibility to that principle would be the arbiter of which explanations obtained by those means are admissible into the science.

2.2.3 Descartes's principle of life as a foundation

We have established that, in order to be an ontic foundation, the principle of life would have to be the 'engine' that drives the body and confers life to it (so as to fulfil the ontic function of the Aristotelian psychic principle of life), as well as being mechanical and material (so as to Cartesianize the principle). In addition, in order to be an epistemic foundation for physiology, Descartes's principle of life would have to be an account derived from (or reducible to) his physics that is sufficiently firm to ground the knowledge of the entire science of physiology.[19] In Descartes's case, the account would be sufficiently firm only if it is fully-reducible to the ultimate foundation of his physics, i.e., extension. This requires explanation in terms of corpuscular mechanics – the shape, size, and motion of subvisible particles.

On the face of things, Descartes's references to his principle of life would appear to fulfil all these criteria perfectly. What such a reading picks up on, however, is Descartes's general claims about the principle of life. It is at this point that it is helpful to distinguish between Descartes's general claims and his actual treatment of the 'principle' within his physiology, because the former tends to obscure the latter. My contention here is that while Descartes's general claims do (at least) appear to present cardiac heat as the epistemic and ontic foundation of physiology, his actual account of physiology does away with any unitary foundation. In this section, I disambiguate the general claims before moving on, in the next, to an analysis of the role that cardiac heat plays in Descartes's account of the body.

When Descartes talks about a principle of life, it is fairly unambiguous that what he has in mind is cardiac heat – or, in a memorable turn of phrase, the 'fire without light' in the heart (AT VI: 46). He sometimes invokes the blood as the principle as well, and, once, the whole body (see §2.4.3, but the scholarship tends to see these references as

[19] There has been a significant amount of work in recent years on elements of Descartes's physiology and medicine that do not seem to be derived from, or even to be compatible with, his physics. These are mostly issues of apparent teleology; see, e.g., Gaukroger (2000) on extrinsic purposes, Des Chene (2001) on the notions of 'function' and 'office', Des Chene (2000a) and Shapiro (2003) on health, Brown (2012) on function, and Distelzweig (2015) on *usus* and function. Given that Descartes makes no claim to task these notions with grounding physiology, they might perhaps come under the remit of the "acceptably obscure" as discussed in §2.2.1, p. 42 above. Teleology is covered in detail in Ch. 6, §6.3 below.

ultimately reducing back to cardiac heat.[20] In the *Treatise on Man*, Descartes tells us that,

> it is not necessary to conceive of this machine [the body] as having any [. . .] other principle of movement and life, apart from its blood and its spirits, which are agitated by the heat of the fire burning continuously in its heart
>
> (CSM 1: 108; AT xi: 202).

Descartes's implicit target here is the Aristotelian conception of life.[21] Vital souls are precisely what Descartes is referring to when he talks about additional principles of life over and above the physical mechanisms of the body (Descartes's 'spirits' here are explicitly material[22]); his point is that we can find everything we need to account for life in the material of the body, and the supposition of a life-conferring soul on top would be a redundant step. From the way he puts it here, it sounds as though everything particular to a living body – its 'movement and life' – has a single underlying principle: blood and spirits agitated by the fire in the heart. And since the agitation of the blood and spirits is itself dependent on the heat of the fire, it seems only natural to simplify the principle further, to the heat in the heart itself.[23]

Descartes is fairly consistent with this description in his general claims about the principle of life. The *Treatise on the Passions of the Soul*, a much later text, begins with a summary of his physiology. Its seventh article is titled 'A brief account of the parts of the body and of some of their functions' (1/7; CSM i: 330; AT xi: 331), which covers the main functions of living bodies, from digestion to circulation to sensation. The next article addresses 'The principle underlying all these functions'. And that principle, it

[20] Bitbol-Hespériès (1990: ch. 3) gives a thorough overview of cardiac heat as the principle of life. See also, e.g., Aucante (2006: 164), Des Chene (2001: 3, 26), Gaukroger (2010: 10–1), Fuchs (2001: 131), Shapiro (2003: 240; 2011: 272, 273, 282), and Smith (2007: 624) for evidence of the consensus that cardiac heat is the principle of life.

[21] Descartes's correspondence with Plempius makes the implicit target entirely explicit: 'how, I ask, can the movement which occurs in the cut-up bits of the heart depend on the human soul, when it is taken as an article of faith that the rational soul is indivisible, and has no other sensitive or vegetative soul attached to it?' (15 February 1638; CSMK: 80–81; AT 1: 523). See also Des Chene (2001: 15ff.).

[22] In *Man*, he calls them 'a certain very fine wind', produced from the finest particles of the blood (CSM i: 100; AT xi: 129–30). As Voss puts it neatly in a note on his translation of the Passions, 'more spiritous than spiritual' (Descartes 1989: 24).

[23] See Bitbol-Hespériès (1990: 38).

seems to claim, is cardiac heat:

> [w]hile we are alive there is a continual heat in our hearts, which is a kind of fire that the blood of the veins maintains there. This fire is the corporeal principle underlying all the movements of our limbs
>
> (*Passions* 1/8; CSM 1: 331; AT XI: 333).

Even more explicitly than the *Treatise on Man*, the *Passions* indicates that there is a principle that acts as the ontic foundation of the body, and that this principle is cardiac heat. From what Descartes claims here, cardiac heat underlies 'all the movements of our limbs'. As such, it drives the body – as Des Chene nicely puts it, '[i]n the cycle of the blood, the motor is the heat of the heart' (2001: 21). Descartes describes cardiac heat as 'corporeal' (and thereby material, and by implication mechanical), and thus non-psychic. On the strength of such general claims about the principle of life, then, it appears that it does indeed serve as an ontic foundation for physiology.

The epistemic side of the ostensible principle comes out in the *Description of the Human Body* (a late text that recapitulates and updates much of the *Treatise on Man*). The preface explicitly puts the *Description* into an epistemological setting. It begins by discussing the importance of medical knowledge, in terms of curing and preventing illness, and for the sake of retarding the ageing process. Descartes then asserts the dependence of medical knowledge on physiological knowledge. Medicine could have obtained better clinical results, he claims, 'if we had studied sufficiently to know the nature of our body' (DHB: 170; AT XI, p. 223–24; translation modified[24]). He continues by explaining that the chief impediment to medical knowledge has been the erroneous attribution of life functions to the soul. This is immediately followed by a claim similar to those we have already seen in *Man* and the *Passions*, that cardiac heat is the ontic principle driving the living body (AT XI: 226). After a detailed account of the heartbeat, circulation, respiration, and nutrition, Descartes provides an explicit statement of the move from the ontic to the epistemic:

> it is so important to know the true cause of the heart's movement that, without it, we cannot know anything about the theory of medicine, because all the other functions in the animal depend on it
>
> (DHB: 182; AT XI: 245).

He seems quite unequivocal that all knowledge of medicine and physiology is dependent on knowledge of 'the true cause of the heart's movement' – in other words,

[24] The original French reads, 'si on s'estoit assez étudié à connoistre la nature de nostre corps' (AT XI: 224).

given the preceding account, on knowledge of cardiac heat. This certainly sounds like an epistemic foundation for physiology. The passage also tells us something about the relation between the ontic and epistemic sides of the principle: we cannot *know* anything about medicine and physiology without knowledge of cardiac heat, Descartes claims, because the ontic constitution of the body is such that all its functions are dependent on cardiac heat as the ontic principle that drives them.

2.3 Accounts of cardiac heat

2.3.1 The source of cardiac heat

Since cardiac heat is so widely identified with Descartes's principle of life (and for good reason), we need to determine exactly what is involved in Descartes's account before assessing whether it can serve as a principle. Merely referencing cardiac heat is not in itself going to be sufficient to make it the Cartesian principle of life. Cardiac heat is already present in relation to the principle of life in the theories of the 'ancients' to whom Descartes so strenuously insists he is opposed.[25] If Descartes is to distinguish his physiology from that of the ancients, he will have to provide an account of the source of cardiac heat that differentiates itself from the psychic account by being reducible to corpuscular mechanics, and ultimately to pure extension itself.

At this point, it might be objected that, as Des Chene (2001: 27) notes, heat is already mechanical for Descartes, given his account of heat as corpuscle movement in the *World* and the *Principles*. If heat itself is mechanical, then, by extension, cardiac heat should also be mechanical.[26] If this is the case, does pointing to heat alone get to count as a mechanical explanation? No, because heat itself is not what is at stake here. While Descartes has provided a material explanation of heat elsewhere, his explanation of cardiac heat cannot bottom out in heat itself. There is another level to the causal story – namely, the cardiac part. The nature of heat itself is not the relevant question here. What is relevant is what causes heat specifically *in the heart*.

[25] See Bitbol-Hespériès (1990: 39) and Aucante (2006: 167–77).

[26] See Hall (1970: 62).

2.3.2 Analogies

In all of Descartes's completed work on physiology and medicine, he accounts for the heat of the heart purely through various allusions and analogies. The most common of these is fire. Thus, respiration is offhandedly described as 'necessary for maintaining the fire in [the] heart' (TM: 102; AT XI: 124), while, according to the *Passions*, 'we die when the fire in our heart is completely extinguished' (2:122; CSM I: 370–71; AT XI: 418). The same general attribution of cardiac heat to some kind of fire comes up again in both *Man* (AT XI: 202) and the *Passions* (1/8; 2/123), as well as in the *Description* (AT XI: 236, 237, 244, 280–82) and the correspondence (AT IV: 407).

In *Man* (AT XI: 123) and the summary thereof included in the *Discourse*, Descartes expands a little on the fire allusion. In the latter, he writes,

> in the beginning God did not place in this body any [. . .] other thing to serve as a vegetative or sensitive soul, but rather [. . .] he kindled in its heart one of those fires without light
>
> (CSM I: 134; AT VI: 46).

The idea of a fire without light might sound odd in itself, but it makes sense in context. In the *Treatise on Light*, an earlier section of the *World*, intended to be published alongside *Man*, Descartes accounts for fire in terms of flame burning wood (AT X: 7–10).[27] There, fire is produced by very fast-moving subvisible bodies breaking apart the particles that make up the wood. Descartes wants to equate the fire that produces heat in the heart with that which produces heat in the flame – simply without the light.

Descartes associates such fires without light with fermentation, and it is comparisons with fermentation that make up the rest of his analogies with the cause of cardiac heat. In the *Discourse*, he claims that the fire in the heart is 'no different from that of the fire which heats hay when it has been stored before it is dry, or which causes new wine to seethe when it is left to ferment from the crushed grapes' (CSM I: 134; AT VI: 46). In the *Description*, the comparison is to yeast (*levain*) (AT XI: 228; AT XI: 282), and the correspondence with Plempius mentions both yeast (AT I: 523) and fermentation in general (AT I: 523, 531; AT II: 69). Descartes's reference to 'the fire which heats hay when it has been stored before it is dry' is particularly relevant, since his account of fermentation, which is given in the *Principles*, addresses its topic solely through the self-heating of damp hay.

[27] The account is reprised in *Principles* 4/80.

Article 92 of part four of the *Principles* is titled 'In things that grow hot but do not shine [*lucent*], such as stored hay' (4/92; CSM 1: 273; AT VIIIa: 256) – the context here is the nature and generation of fire, introduced in article 80. The claim is that heat can be caused by the movement of the sap within pieces of hay. There are channels in a blade of grass through which the sap usually flows; under normal circumstances, it would evaporate through those channels as the grass dries. But, as a blade of grass dries, its parts constrict, and, under certain conditions, the channels will constrict enough to seal themselves before the sap can evaporate. When that happens, the sap is forced faster and faster through smaller and smaller, ever-shrinking channels. This movement agitates the matter around it, causing heat. This, Descartes tells us, is a form of fermentation, and all fermentations operate in the same basic fashion: relatively large particles of matter get forced to move faster than normal (AT VIIIa: 256).

Descartes has a mechanical explanation of fermentation, then – at least in the case of drying hay. He also claims that cardiac heat is caused by a kind of fermentation (or that its cause is like fermentation). Nevertheless, it is still not at all clear how the hay model applies to the heat of the heart. On Descartes's account there is no hay in the heart – and not obviously anything like it – and there is nothing in the process of drying. The account of fermentation in damp hay seems to apply to a fairly narrow set of circumstances. This is a very different set of circumstances from those in the heart. As such, the comparison with hay is not, by itself, going to show anything more than a very weak similarity between the two processes. Translating the model to the heart would require further specification of how the mechanical causes of fermentation in hay are manifested in the heart.

2.3.3 Blood-expulsion

Further specification is not provided in the discussions of cardiac heat in *Man*, the *Discourse*, or the *Passions*; nor is it to be found in the extended treatment that makes up part two ('On the motion of the heart and the blood' (DHB: 172; AT XI: 228)) of the *Description*. It comes up instead, somewhat incongruously, in a section of the *Description* concerned with embryology. There, Descartes provides a brief but complete account of the cause of cardiac heat through blood expulsion:

> I do not know of any other fire or any other heat in the heart other than the agitation of the particles of blood, nor of any other cause which can serve to maintain this fire except only that, when most of the blood leaves the heart at the time of diastole, those of its particles which remain there enter into the flesh, where they find pores arranged in such a way, and fibres agitated in such a way, that there is

> only matter of the first element surrounding them; and at systole these pores change shape because the heart lengthens, which makes the particles of blood, which remained there as if they were to serve as yeast, leave there with a great speed, and in this way entering easily into the new blood coming into the heart, they make its particles separate from one another, and in separating thus they acquire the form of fire.
>
> (DHB: 203; AT XI: 281–2).

This has fairly clear parallels with the account of fermentation in hay, although Descartes does not make them explicit. The blood that remains in the heart is the equivalent of the sap in the blade of grass. It sinks into pores in the flesh of the heart, which play the role of the channels in the grass. At systole (which is the passive phase of the heartbeat for Descartes), the heart relaxes into an elongated shape,[28] which causes the pores to be laterally compressed. This compression of the pores stands in for the constriction of the channels in the drying hay, expelling the particles of blood from the flesh of the heart wall, and into the new blood that enters the heart concurrently. The agitation of the accelerated blood particles, in turn, agitates the particles of the new blood, making them move and thus producing heat.[29] This causes the blood to expand, on the macro level, and the heart goes into diastole, and the whole process repeats.

This passage provides a translation of the account of fermentation in hay over to the production of cardiac heat. It does what the analogies Descartes employs in his completed works, in his correspondence, and in the *Description*'s own treatment of cardiac motion do not: it explicitly accounts for the generation of heat specifically in the heart.

2.4 Interdependence and the case against an ontic foundation

2.4.1 Interdependence and the engine of the body

On the basis of Descartes's explanation of the cause of cardiac heat, we can assess whether the heat of the heart can be said to 'drive' the body on his account of physiology (and thus whether it can serve as the ontic principle of the movement of the living body). On my reading, it will turn out that there can be no unitary principle

[28] See *Description* 2/10 (AT XI: 231).

[29] Fuchs describes this stage of the process as a 'ceaseless chain reaction' (2001: 128), brought about by the ejection of the old blood (however, there is no indication of any chain reaction in Descartes's account).

driving the Cartesian body, just because the major systems of Descartes's physiology are interdependent rather than being organised hierarchically: no one system can be more fundamental than another.

When Descartes writes that we 'move just like automatons, and nobody thinks that the force of heat is insufficient to cause their movements' (to Plempius for Fromondus, 3 October 1637; CSMK: 63; AT 1: 414), he appears to be quite clear that it is heat that drives the body. If cardiac heat were the engine of the body, it would drive the body's movements just because it causes the blood to circulate and because it produces animal spirits. This is how he describes the operation of the body in the preface to the *Description*:

> the heat that [the body] has in its heart is like the great spring or the principle of all its movements, and [. . .] the veins are the tubes which conduct the blood from all the parts of the body towards the heart, where it fuels the heat there] [. . .]. And the arteries are yet another set of tubes, through which the blood, heated and rarefied in the heart, passes from there into all the other parts of the body, to which it brings heat and matter to sustain them. Finally, the most agitated and most active parts of this blood are carried to the brain [. . .], comprising an air or very fine wind which is called the "animal spirits". These dilate the brain, enabling it to [. . .] [act] as the organ [. . .] of the common sense, of the imagination, and of the memory. Then, [. . .] these same spirits flow from the brain through the nerves into all the muscles, thereby making these nerves serve as organs of the external senses, and inflate the muscles in various ways imparting movement to all bodily parts
>
> (DHB: 172; AT XI: 226–7).

Cardiac heat rarefies and heats the blood, which pushes it out through the arteries, whereby heat and nutrition is provided throughout the body. Cardiac heat also creates animal spirits, in the form of the smallest, most agitated particles of blood, which are released in the process of heating and rarefaction. The spirits, too, are pushed out of the heart by the rarefaction of the blood, and through the nervous system, whereby they power brain and sensation functions and '[impart] movement to all bodily parts'.

On the basis of this description, the causal dependency relations within the body do appear to go one way: functions such as digestion and muscular movement depend on the circulatory and nervous systems respectively, which both depend on cardiac heat (and, ultimately, on the blood-expulsion that drives cardiac heat). On this account, cardiac heat gets to be the engine of the body because it sits at the bottom of the hierarchy: cardiac heat is the engine if that is where all dependencies in the body ultimately bottom out.

However, merely stating that such and such a thing is the principle behind something or other does not, in itself, make it that principle – at least, not for a Cartesian.[30] The position needs to be substantiated. In the case of Descartes's principle of life, we need to establish whether it really does provide the motive power behind the movements of the body. (We also need to establish whether knowledge of the principle of life is used as the epistemic foundation of the science of physiology.)

For Descartes, heat itself is nothing but movement (AT XI: 10). For him to claim that what drives the movements of the body is heat, while what causes heat (in the body) is movement (in the body) would be akin to claiming that movement in the body is caused by movement in the body; that is, it would be circular. Heat in itself thus cannot serve as the ontic foundation of the body: we need the cause behind the heat. The blood-expulsion account supplies that cause. Consequently, it is the blood-expulsion account that we need to look at in order to establish whether cardiac heat can act as the engine that drives the body. To put it another way, cardiac heat has a further dependency: blood-expulsion. In order to see where, or indeed if, the dependencies in the body bottom out, we need to examine the dependencies for blood-expulsion.

According to the blood-expulsion account, cardiac heat is caused by the expulsion of particles of blood from the heart wall into cooler, non-rarefied blood that is simultaneously entering via 'the vena cava into [the] right ventricle, and [. . .] the pulmonary vein into the left' (DHB: 174; AT XI: 231). This is what causes the heating and rarefaction of the blood that supposedly drives both circulation and animal-spirit production (and consequently the whole process of bodily functioning that Descartes describes in the preface to the *Description*). But, on Descartes's account above, the production of cardiac heat through blood-expulsion depends on the following activities: (a) the addition of 'fresh' blood to the ventricles and (b) the expulsion of blood particles from the heart wall. In order to have (a), the body needs both (a.1) blood and (a.2) a means of delivering it to the heart (i.e., circulation). And in order to have (b), the body needs both (b.1) blood in the heart wall and (b.2) a means of ejecting it at sufficient speed. Immediately, then, we see that blood-expulsion is dependent on something further. This means that the dependencies in the body cannot bottom out at blood-expulsion.

[30] A non-Cartesian science might well be founded on an axiomatic principle that is not explained further. But any founding principle of Cartesian physiology would have to reduce all the way down to extension, the ultimate foundation of his natural philosophy.

Following the dependencies for (b), we see that (b.2) depends on heart-lengthening. The pores of the heart wall 'change shape because the heart lengthens', and this is what 'makes the particles of blood [. . .] leave there with a great speed' (DHB: 203; AT XI: 281–2). Heart-lengthening itself is caused by the deflation of the heart following the active phase of the heartbeat (AT XI: 232). So, blood-expulsion is partially dependent on (b), which is partially dependent on (b.2), which depends on heart-lengthening, while heart-lengthening is caused by heart-deflation, which itself is an effect of heart-inflation. And heart-inflation is dependent on blood-expulsion. Any given activity in the process – blood-expulsion, heart-lengthening, heart-deflation, etc. – is dependent on the other activities in the process. That is, the entire process is circular, and the activities within it are interdependent. Similarly, a small amount of blood remains in the heart wall (b.1) only as a result of the previous active phase of the heartbeat (AT XI: 231), while the active phase is itself partially dependent on (b.1).

The dependency story plays out in the same way with (a). The addition of fresh blood to the ventricles partially requires the whole circulatory system (a.2) to bring the blood that was previously sent out from the heart back into it. At its simplest, we can say that, for Descartes, circulation depends on the heartbeat, which depends on the expansion of blood, which depends on cardiac heat, which depends on blood-expulsion, which depends on circulation, and so on. Thus, circulation and cardiac heat are interdependent (along with blood-expulsion, heart-inflation and deflation, etc.). Descartes's account, however, is not quite so simple. The dependencies for cardiac heat bring in at least two more bodily functions: digestion and respiration. The addition of fresh blood via the circulation requires a supply of blood (a.1), which depends on the production of blood within the body. On Descartes's account, the production of blood depends on digestion (AT XI: 122, 227). But digestion depends on the circulation of warm blood to provide it with the movement and material it requires to operate (AT XI: 121). Without circulation and cardiac heat, there would be no digestion – but without digestion, there would be no circulation or cardiac heat. As such, digestion, circulation, and cardiac heat are all interdependent.[31]

In addition, in order to derive the fresh blood that re-enters the heart from the

[31] In the *Description* (AT XI: 239), Descartes mentions that the circulation would be a process of perpetual motion, if it were not for the loss of blood particles through nutrition. In a body without nutrition, there would be no need for digestion. In that case, digestion itself would not be one of the interdependent systems. Regardless, the body Descartes is describing is one in which there is nutrition, for which it is clear that, without digestion, cardiac heat, circulation, and respiration would fail, and that digestion therefore belongs among the interdependent functions. On the connection between interdependence and systematicity in Descartes's physiology, see Ch. 1.

recirculating blood in the veins, Descartes's physiology requires respiration:

> by means of the respiratory air, [the lung] thickens and tempers the blood that comes from the right ventricle of the heart before it enters the left ventricle; *without this it would be too rare and too fine to serve to fuel the fire that it encounters there*
>
> (DHB: 177; AT XI: 236; my emphasis).

If there were no respiration, there would be no production of cardiac heat.[32] Consequently, cardiac heat depends on respiration. At the same time, there would be no respiration without the flow of blood to the lungs, and without the movement with which the warm blood supplies them. Thus, respiration, circulation, cardiac heat, and digestion are all interdependent. Each depends on the others, and the absence of any particular one would prevent the operation of each and all the others.

Given this interdependence of bodily functions, a reading of Descartes's physiology in which cardiac heat is the underlying ontic principle of the living body – the engine that drives it – becomes untenable. At no point in the cycle is there reason to stop and name that particular stage the 'engine'. There is no single originator of movement in the body. There is no physiological first mover. There is nothing that fulfils the same role as the Aristotelian soul. There could be no cardiac heat without blood-expulsion, and there could be no blood-expulsion without fresh blood entering the heart and without the discharge of blood particles from the ventricle wall. But blood-particle discharge requires heart-lengthening, which requires heart-deflation, which requires heart-inflation, and so on. None of which could occur anyway without the supply of blood that is dependent on digestion, or without the interposition of respiration.

There is no one point at which the dependencies bottom out. Instead, they continue in a perpetual circle throughout all of these bodily functions. The circularity in Descartes's treatment of cardiac heat (movement caused by heat, but heat caused by movement) is thus virtuous rather than vicious, but only as a result of the interdependence of the functions involved. Descartes's physiology, therefore, cannot be hierarchical and ultimately driven by a single underlying principle. If there is an engine that drives the Cartesian body, it cannot be a single function; it must rather be the collection of interdependent functions as a whole that drives the body. The answer to the question raised in §2.2.1 – whether Descartes replaces the Aristotelian soul (or the Paracelsian master *archeus*) with a principle of life compatible with his ontology – is thus a 'no'. He retains the organisation of the parts of the body, and he makes that organisation do all the work. He does away with the underlying principle entirely.

[32] The same point is made in *Discourse* 5 (AT VI: 53).

2.4.2 Interdependence and generation

A potential objection to the argument here is that there is another sense in which cardiac heat might be conceived of as the underlying principle of life – not as the engine that continuously drives the body, but as the body's developmental point of origin. In Descartes's account of generation in the *Description*, the heart is the first organ in the embryo to begin to develop (AT XI: 254). Given that the heart develops via the heat generated by fermentation of the "mixture of seed" (DHB: 187; AT XI: 254), and that Descartes claims that 'this movement of the diastole has from the beginning been caused by heat, or the action of fire [in this case, the "fire" of the fermenting seed from which the heart develops]' (DHB: 202; AT XI: 280–81), there is a fairly clear argument for seeing the warm heart as the first principle, or the initial term, of life in the body.

However, even here, in the earliest generation of the heart, the dependency relations do not go one way only. Brown (2012) shows how the development of the embryo, on Descartes's account, requires the interdependence of the processes involved: 'the formation of the brain is necessary for the persistence of the heart and the formation of the heart a necessary precondition for the formation of the brain' (2012: 12). Because the processes of generation form a virtuous circle of interdependence, exactly as do the bodily systems that maintain the ongoing operation of the body, the warm heart developing in the embryo has to share first position in the body with the other interdependent processes of generation. Consequently, there can be no single underlying principle of life in the generation of the Cartesian body either.

2.4.3 Interdependence and Descartes's general claims

Even in his general claims, Descartes does not always refer to a unitary principle. When he brings up the 'principle of movement and life' in *Man*, he first equates them with the man–machine's 'blood and its spirits', before going on to tell us that the blood and spirits are 'agitated by the heat of the fire burning continuously in its heart' (CSM I: 108; AT XI: 202). Similarly, in a letter to Plempius for Fromondus, he claims that 'the souls of animals are nothing but their blood, the blood which is turned into spirits by the warmth of the heart' (3 October 1637; CSMK: 62–3; AT I: 414).What is invoked in both these passages is something more than just cardiac heat, although it could certainly be argued that Descartes sees the principle underlying the blood and spirits here to be the heat of the heart.

There are other passages, however, that suggest Descartes might have been aware that

his physiology actually operates on the basis of interdependence. In a letter to Plempius, Descartes attributes the rarefaction of blood in the heart to '[t]he entire structure [*fabrica*] of the heart, the heat in it, and the very nature of the blood', all of which 'contribute [*conspirant*] to this effect' (15 February 1638; CSMK: 83; AT 1: 529; translation modified). As discussed in §2.3 , it is the rarefaction of the blood that causes its expulsion from the heart. It is also blood rarefaction that creates the spirits. And, here, Descartes is explicit that its dependencies do not bottom out in cardiac heat, but that it is the product of several conspiring factors, with none being more fundamental than any other.

Even more tellingly, in a letter to Regius Descartes writes,

> [t]he vegetative power in human beings is nothing but a certain arrangement [*constitutio*] of the parts of the body
>
> (to Regius, May 1641; CSMK: 182; AT III: 372).

He sees the engine of the body not as a single underlying principle, but as a collection of parts in a certain arrangement. The analysis in this chapter would suggest that we think of this arrangement of parts as the circle of interdependent functions. In a very similar vein, the *Passions* claims that

> death never occurs through the absence of the soul, but only because *one of the principal parts of the body* decays
>
> (*Passions* 1/6; CSM 1: 329; AT XI: 330; my emphasis).

When the body dies, it is because of the breakdown of any one of some group of 'principal parts'. Descartes himself does not qualify which parts he takes to be principal, but, given the reading in §2.4.1, they must be those parts or functions that are interdependent. It is precisely the interdependent functions for which, if one ceases to operate, the whole body ceases to operate: death occurs if any of the principal parts decays exactly because each part is dependent on all the others. Descartes is quite clearly not placing the responsibility for life and death solely in the hands of cardiac heat: he explicitly does not offer cardiac heat alone as his alternative to the Aristotelian psychic principle of life. Instead, he places responsibility for the life of the body in the entire collection of principal parts.

2.5 The case against an epistemic foundation

If physiology is structured interdependently rather than hierarchically, it can have no single underlying ontic principle. Given that Descartes's general claims make any epistemic principle of the science of physiology dependent on the ontic principle (§2.2.3), there is sufficient reason to conclude that his physiology has no single underlying epistemic principle either. But there is another case to be made against there being a single principle grounding the Cartesian sciences of physiology and medicine.

If cardiac heat were the principle on top of which knowledge of physiology is built, Descartes's treatment of it in his work on physiology would be remarkably strange. He deals with it offhandedly, devoting at least as much attention to the 'auricles' of the heart, or to the proper designation of the pulmonary vein and artery, as to the generation of heat in the heart. There is a considerable difference between the amount of detail allotted to, say, the mechanism of nutrition and that afforded to the cause of cardiac heat. Recall (from §2.3.1) that, in all of his completed work, Descartes addresses the generation of cardiac heat solely through analogies and allusions. These analogies are vague and incomplete, and they get changed, mixed together, and recycled throughout Descartes's various works on the subject, in a way reminiscent of the interchangeable tropes of an elevator pitch ('the principle of life is like yeast meets damp hay').

If all that were at stake here were just some physiological phenomenon or another, the lack of specificity about the mechanism might well not matter epistemically. It would be what Des Chene calls a 'proof of concept' (2001: 17): these kinds of things can happen in this kind of way.[33] But knowing that fermenting wine effervesces or that drying hay heats up, in entirely different contexts, seems far too slight to serve as the foundational principle of a science for Descartes. These analogies do suggest that generation of heat and ebullition can be a material, non-psychic process, but without further specification, they are insufficient for a foundational principle. As established in §2.2.2, an epistemic foundation would have to comprise a well-specified account that reduces down to the principles of physics. The analogies alone do not fit that bill. What Descartes needs is a mechanical explanation of fermentation, and of how it (or something like it) occurs in the heart.

[33] See also Hatfield (1992: 343) and Manning (2012).

He does have such an explanation: the blood-expulsion account. But Descartes never uses that account to explain cardiac heat in any of his general physiology. The blood-expulsion account is given in the fifth part of the *Description of the Human Body*. The *Description* is an unfinished manuscript that Descartes worked on over the last couple of years of his life (it was composed between 1647 and 1648). It is divided into five separate parts: the first three cover the introduction, the heartbeat and circulation, and nutrition respectively, while the remaining two address embryogenesis and embryo development. In a 1648 letter to Elisabeth, Descartes describes embryology as being of the greatest necessity to his work, but complains that he lacks the relevant data (AT v: 112). The draft he finally produces is famously tenuous. In the 1664 edition (its first, and posthumous, publication), Descartes's editor Clerselier even sets the fourth and fifth parts of the *Description* aside, under the heading 'Digression, in which the formation of the Animal is treated' (AT xi: 252).[34] And it is in this context – and only in this context – that Descartes employs the blood-expulsion account.

If this were meant to be the firm account that finally grounds Descartes's science of physiology, its relegation to a tentative treatment of embryology seems a strange choice. It makes no appearance in the first three parts of the *Description*, which are concerned precisely with the functioning of the body and the epistemic value thereof (see §2.2.1). When explaining the heartbeat, the *Description* employs only the vaguer allusions and analogies covered in §2.3.2. In addition, since the blood-expulsion account was written in 1648 at the latest, there would have been ample time to insert it into the *Passions*' discussion of the principle of life and cardiac motion before publication at the end of 1649.[35] But we find no mention of it there either; all the *Passions* tells us is that cardiac heat is caused by 'a kind of fire' (CSM i: 331; AT xi: 333). If blood expulsion were the account that finally mechanised the very foundation of his physiology, we might well expect Descartes to be eager to include it in his newest work – a work which also happened to be the most thorough treatment of physiology he had yet to publish.[36]

If we take cardiac heat to be the grounding principle of Descartes's physiology, it is difficult to make sense of the remarkably laid-back approach he has to addressing the

[34] Adam and Tannery note that the heading appears to be due to Clerselier rather than to Descartes himself (AT xi: 252).

[35] The *Passions* was officially published at the beginning of 1650, but copies were available the preceding December.

[36] *Man* remained unpublished until 1662 (in a Latin translation).

generation of heat in the heart. However, if cardiac heat is just one physiological phenomenon among many, and no more fundamental than circulation, respiration or nutrition, his treatment of it makes perfect sense. A proof-of-concept explanation is sufficient for one phenomenon among many. And a better specified explanation can reasonably remain buried in an obscure manuscript if nothing pivotal rests on the phenomenon in question.

The introduction to the *Description* might claim that we 'cannot know anything about the theory of medicine' without knowing "the true cause of the heart's movement" (DHB: 182; AT XI: 245), but it is evidently a mistake to take that cause to be cardiac heat. We might still need to know the true cause of the heart's movement, but the cause is exactly what Descartes sets out in the sections of the *Description* that follow: the entire physiology of the interdependent "principal parts" of the body.

2.6 Conclusion

Descartes makes multiple references to a 'principle of life', or to a principle that underlies the body's operations. This principle appears to be cardiac heat. There are some good reasons for taking these references to point to an ontic foundation of Cartesian physiology – where an ontic foundation is the 'engine' that 'drives' the body, or the point at which all the dependencies in the body bottom out. There are also good reasons to go further and interpret Descartes's 'principle of life' as an epistemic foundation, on which all the knowledge of his physiology is grounded.

If, however, we look at the dependencies of cardiac heat, we see that it cannot be the ontic foundation of Cartesian physiology, because the Cartesian body is not driven by a single 'engine' principle. Instead, the living body operates on the basis of a collection of interdependent bodily functions. These are (at least) cardiac heat, circulation, digestion, and respiration. In addition, cardiac heat cannot be the epistemic foundation of Cartesian physiology, since Descartes takes his epistemic foundation to depend on his ontic foundation. Thus, the structure of Cartesian physiology is not hierarchical, either ontically or epistemically, but interdependent. Precisely because it is structured interdependently, Cartesian physiology has no place for a single, underlying 'principle of life'.

Chapter 3

Descartes and the dissolution of life[1]

3.1 Introduction

In this chapter, I argue that Descartes is not a reductionist about life, but that he dissolves or eliminates the category entirely. This is surprising both because he repeatedly refers to the life of humans, animals, and plants and because he appears to rely on the category of life to construct his physiology and medicine. Various attempts have been made in the scholarship to attribute a principled concept of life to Descartes. Most recently, Detlefsen (2016) has argued that Descartes 'is a *reductionist* with respect to explanation of life phenomena but not an *eliminativist* with respect to life itself' (2016: 143). I show here that all these attempts either result in arbitrariness or force Descartes's wider philosophical project into incoherence. I conclude that Descartes's ontological commitments make a principled concept of life impossible, that he does not need such a concept, and that his project ends up more coherent without one.

Life ought not to be a category for Descartes. For the scholastics, to whom Descartes was responding on this issue, the vegetative soul could do the work of distinguishing ontologically between the animate and the inanimate: whatever had a vegetative soul was alive; whatever did not was not. This avenue was not open to Descartes. His ontology allows for only one kind of soul, which consists of thinking and absolutely nothing more – and animating a body is not, on his understanding, a kind of thinking (to Regius, May 1641; AT III: 371). Consequently, in Descartes's ontology, there should

[1] A version of this chapter is forthcoming in *The Southern Journal of Philosophy*.

be no more of a 'difference between living and lifeless things than there is between a clock or other automaton on the one hand, and a key or sword or other non-self-moving appliance on the other' (to Regius, June 1642; CSMK: 214; AT III: 566). In other words, life can have no special ontological distinction.

And yet Descartes persists in referring to 'life' and to 'living things'. He does not 'deny life to animals' (to More, 5 February 1649; CSMK 366; AT V, 278). He admits that severed heads that 'continue to move about and bite the earth' are '*no longer* alive' (*Discourse* 5; CSM I, 139; AT VI, 55; my emphasis). He repeatedly brings up his own 'principle of life' – a material, Cartesian alternative to the Aristotelian vegetative and sensitive souls.[2] And in the letter to Regius quoted above, he goes on to say that,

> [s]ince "self-moving" is a category with respect to all machines that move of their own accord, which excludes others that are not self-moving, so "life" can be taken as the category [vita *sumi potest pro genere*] which includes the forms of all living things
>
> (to Regius, June 1642; CSMK: 214; AT III: 566; translation adjusted).

So, although life ought not to be a category for Descartes, he appears to make it one (at the very least, he explicitly does not rule it out). The problem is that, as both MacKenzie (1975: 2–3) and Detlefsen (2016: 145) point out, Descartes never provides a general concept of life. Given that his metaphysics does not allow him an ontological differentiation, it is not at all clear how the category of life can possibly be defined within his philosophical system. Just as it struggles with teleology, a purely material, mechanical ontology seems to lack the resources to separate out living creatures from the rest of the material world.

In what follows, I first assess the various suggestions for a Cartesian concept of life as found in the literature (§3.2). There has been a series of systematic attempts to unearth a principled concept of life for Descartes, starting with MacKenzie (1975), who builds on some ideas from Hall (1970). The task is taken up again by Ablondi (1998) and then Detlefsen (2016). All take Descartes to have a general, principled concept of life, and each sees him as a reductionist, in one way or another, about that concept. They take him to reduce life to some thing, or to some set of things, in the material world (for Ablondi and Detlefsen, God also has a role to play in the reduction). Each of these articles shows how the concept put forward by its immediate predecessor is inadequate, arbitrary, or just plain wrong, before offering an alternative concept of its own.

[2] See Ch. 2.

My claim here is that the reason all these purported concepts of life turn out to be so unsatisfying is that looking for a general, principled concept of life in Descartes is the wrong approach to start with (§3.3). Since he is entirely clear that life (whatever it might be) does not pertain to thinking substance (*Passions* 1/5; AT XI: 329), it cannot be reducible to pure thought. But because his material ontology lacks the resources to discriminate the living from the non-living, there is nothing in extended substance for life to be reduced to either. And, as Detlefsen points out (2016: 155, 168–169), Descartes commits himself to the inscrutability of God, for good reasons (AT VII: 55, 374–5), thus making God unavailable to support a concept of life. There is nowhere in Descartes's ontology for a concept of life to reside.

The more suitable approach, then, is to think that Descartes does away with a concept of life (§3.3.1). He does not reduce it to something material. He does not look to God's intentions. What he does is dissolve or eliminate the category. Rather than addressing his account of physiology to the nature of life itself, and to finding a material source for it, Descartes takes on the traditional phenomena of physiology (cardiac heat, respiration, nutrition, generation, etc.) one by one and provides a material explanation for each. These explanations do not afford the reconstitution of any general, univocal concept of life. Consequently, in the process, the concept is dissolved away.[3] If I am right about this, it means that Descartes recognised something that Machery has far more recently proposed for modern biology: that 'the project of defining life is either impossible or pointless' (2012: 145).

There are parallels between this reading of Descartes and eliminativist materialist positions with respect to the mind. In eliminative materialism, 'thoughts', 'beliefs', 'mind states', etc. are merely the terms of folk psychology, and they fail to refer to anything real. That is, there is nothing to which they can be reduced. As such, neuroscience has no need to attempt to explain them (nor could it): mind states should be eliminated from the science, which should focus instead on physical brain states. In his landmark paper on the elimination of propositional attitudes, Paul Churchland concludes

> [t]he propositional attitudes of folk psychology do not constitute an unbreachable barrier to the advancing tide of neuroscience. On the contrary, the principled

[3] *Cf.* Wolfe (2011: 192), which argues that there was no early modern controversy over life because there was 'no polarization between Life and non-Life'. Descartes is, however, responding to a problem driven by a polarisation between life and non-life; it just turns out that this is a problem that arises with respect to a tradition he rejects (see §3.3.2).

> displacement of folk psychology is not only richly possible, it represents one of the most intriguing theoretical displacements we can currently imagine
>
> (1981: 90).

Similarly, doing away with the notion of life itself is, presumably, a productive displacement that gives Descartes new possibilities (such as pervasive iatromechanism) for his work on physiology and medicine.

There are several advantages to the 'dissolutionist' reading. Most importantly, it makes sense of the complete absence of an attempt to work out a general concept of life anywhere in Descartes's work and correspondence (if the lack of a concept of life 'would render incoherent' Descartes's work on physiology and medicine, as Detlefsen claims (2016: 142), for him to ignore it as he does would be a significant oversight). It is also non-arbitrary, in a way that MacKenzie-style lists of necessary life-functions are not (see §3.2.3). And it remains consistent with both Descartes's ontological and theological commitments. On the other had, it might appear difficult for the dissolutionist reading to make sense of Descartes's use of the term 'life'. This problem is dealt with in §3.3.2. One answer may be that Descartes uses 'life' as a folk term, without any strict definition. I argue, though, that most instances of Descartes' use of 'life' are responses to the Aristotelian position, where the term *is* well defined. Descartes's intention is to show that all the phenomena associated with life in the Aristotelian system are explicable under his own; this does not entail a subscription to the category of life itself. Concerns about whether Descartes can allow disciplinary unity to biology in the absence of a concept of life are addressed in §3.3.3. There, I argue that Descartes has no particular need for a principled unification of the discipline, and that whatever unity it may have is provided not by life but by (human) medicine. This allows life itself to be redundant for Cartesian biology.

3.2 Potential reductions of life

3.2.1 Cardiac heat

Although Descartes never provides a general definition of life, he does frequently associate life with heat. For instance, he writes to Mersenne,

> [b]ut as to why you say that we cannot explain this phenomenon while allowing *no principle of life other than heat* to animals, it seems to me, on the contrary, that we could explain it better in no other way; given that *heat is a common principle for*

> *animals, plants, and other bodies*, it is no surprise that it should serve to make humans and plants live
>
> (AT III: 122; my emphases).

So heat makes humans, plants, and animals live. But whatever Descartes might take life to be, it cannot come down to heat alone. This is because, as Descartes puts it, heat is a principle common to not just humans, animals, and plants, but also to 'other bodies'. That is, heat is also a principle of inorganic bodies.[4] There are plenty of things in the natural world that are both warm and clearly non-living. Consequently, there is nothing about heat in itself that distinguishes between living and non-living. So if Descartes has a concept of life and that concept involves heat, it must involve heat in addition to something else.

That something else would appear to be the heart. Descartes makes various seemingly straightforward statements such as 'I do not deny life to animals, since I regard it as consisting simply in the heat of the heart' (to More, 5 February 1649; CSMK: 366; AT V, 278). Elsewhere, he appears to identify cardiac heat as the principle of life (AT VI: 46; AT XI: 202; AT XI: 333). When Descartes appeals to this principle of life, and when he claims that life consists in cardiac heat, it certainly looks like a reduction of the concept of life to a material process.[5] This would suggest that his concept of life is the following.[6]

> **Life**$_{CH}$:= the possession of a warm heart

There is an obvious problem with taking Life$_{CH}$ to be Descartes's concept of life: we want to describe plants as living, but would not want to attribute warm hearts to them.[7] In addition, Descartes is quite clear that cardiac heat alone is not sufficient for life:

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[4] It is central to Descartes's argument to Mersenne here that prevalence of heat as a motive force in inorganic phenomena is good reason to think it plays a role in organic phenomena too.

[5] Cardiac heat is generated entirely mechanically and materially on Descartes's account. See Fuchs 2001, part D.I for a detailed description.

[6] This seems to be the concept of life presupposed in Bitbol-Hespériès 1990 (see especially 40 and 96). Life$_{CH}$ is also endorsed (although only in passing) by Canguilhem (1980: 111).

[7] In a letter to Mersenne, Descartes attributes heat to the life of plants (30 July 1640; AT III: 122), but not hearts. See p. 62 above. Ablondi (1998: 183) cites a passage from the *Cogitationes* as more evidence for the same, although Descartes's concern there is with the role of heat for the development of plants and animals rather than for life itself.

> the tiny heart of an eel, which I cut out before seven or eight o'clock this morning, revives when a little heat is applied to its surface, and begins to beat again quite rapidly, *even though it is obviously dead*
>
> (23 March 1638; CSMK: 95; AT II: 66; my emphasis).

In this case, the heart is warm (and even beating) but nevertheless does not qualify as living.[8] Cardiac heat, therefore, cannot be not sufficient for life on Descartes's account. Consequently, if Descartes has a concept of life, it cannot be Life_{CH}.

3.2.2 Cardiac heat plus an ensemble of life-functions

When we say that Life_{CH} cannot be Descartes's concept of life, the objection that immediately springs to mind is that cardiac heat might not be sufficient by itself but could still be necessary when buttressed by some other condition for life. In this case, the reduction of life would be to cardiac heat plus one or more other material process. This appears to be Hall's approach to the Cartesian concept of life:

> **Life**$_{\text{H}}$:= 'an ensemble of functions that have their kinetic origin in heat—specifically a certain "fire without light" that burns, in men and animals, in the heart' (1970: 61).

Life_{H} deals nicely with the case of the dead-but-warm eel heart: the eel heart is dead because it is not acting as the source of movement for some ensemble of functions. If the eel's warm heart were instead driving its life functions, it (or, rather, the eel) would be alive. Hall does not identify these functions, leaving Life_{H}, as it stands, somewhat vague. But the principle behind it is straightforward: life is not simply the heat of the heart, but a group of life-functions that are driven by the heat of the heart. It is the combination of cardiac heat with the ensemble of functions that is meant to provide sufficiency to the concept. In this case, it does not matter too much exactly what the functions are: they are life functions precisely because they are driven by the heat of the heart that is unique to living bodies. The life-functions are necessary here just because cardiac heat alone is insufficient for life, but it is still cardiac heat that does the bulk of the work in Life_{H}.

The immediate problem is that Life_{H}, in this form, would rule out plant life (because plants do not have hearts) – and Descartes seems to be just as willing to ascribe life to

[8] An alternative reading of this passage might claim that the heart really does come back to life (the use of 'revives' (*reviviscere*) would support that reading). However, from the context, it is clear that Descartes's aim is to show that the phenomenon of the heartbeat can be reproduced at a point after an Aristotelian would say the soul has left the body.

plants as to animals. In both the *Principles* (4:188; AT VIIIA: 315) and the *Description of the Human Body* (AT XI: 247), he glosses 'living things' as both plants and animals, and in the conversation with Burman, Descartes mentions prolonging the lives of plants as a model for prolonging human life (AT V: 178). If we want to find a concept of life in Descartes, the basic form of Life_{H} is evidently going to be too exclusive.

There might be some traction in generalising the definition by omitting the specification after the dash in Hall's formulation:

> **Life**$_{\text{H}_2}$:= an ensemble of functions that have their kinetic origin in heat.

This obviates the need to refer to the heart itself. And since there is at least one instance in which Descartes claims that plants too are driven by heat (AT III: 122), Life_{H_2} is inclusive enough to account for plant life. However, without the restriction of specifically *cardiac* heat and its fire without light, the concept becomes too inclusive. Take, for example, the heating and water-boiling functions of a stove. They have their kinetic origin in heat.[9] If we want an overarching concept of life, presumably we want it to exclude stoves while including plants. Since heat as kinetic origin is not specific enough to provide that restriction, it makes sense to look to the functions themselves: if it is only certain functions that are life-functions, and if water-boiling and heating are not on the list, the concept can effectively exclude stoves while including humans, animals, and plants. In the next section, I look at how MacKenzie builds on exactly this basis in attempting to specify a Cartesian concept of life (1975: 4).

3.2.3 A list of life-functions

Where Life_{H} relied on the specificity of cardiac heat as source of motion to identify a given function as a life-function, MacKenzie explicitly moves the burden of specification to the functions themselves:

> [t]he principle of motion in plants and animals without hearts will be that which (together with proper structure) enables them to engage in those determinate activities which in turn enable them to perform their life functions. [. . .] Although all living creatures perform the same set of life functions, because of the vast set of differences among animate creatures, the determinate activities that enable them to perform the life functions differ
>
> (Mackenzie 1975: 10).

[9] Heating is always kinetic for Descartes. See *The World,* part 1, ch. 2 (AT XI: 7–10).

This is a straightforward reversal of the hierarchy in Life_{H}. The life-functions are constant, but the activities that produce them can differ – in some cases, it will be cardiac heat that drives the life-functions, and in others it will be something else. On MacKenzie's reading, rather than doing the bulk of the work in defining life, cardiac heat gets to be involved in life only if it produces life-functions. It is the functions themselves that do the work. Indeed, activities such as cardiac heat will figure in MacKenzie's definition only in the general stipulation that they be mechanical and material, so as to rule out psychistic principles of life (Mackenzie 1975: 6).

The functions MacKenzie identifies as life-functions are simply nutrition, growth and generation (1975: 8). Accordingly, her (explicitly stated) definition is

> **Life**$_{\text{MK}}$:= 'x is alive if and only if x has an arrangement of parts which (together with motion) enables x to gain nourishment from its environment, to grow, and to reproduce' (1975: 8).

In this definition, cardiac heat has been generalised to an arrangement of parts plus motion, which is inclusive enough to allow life to humans, animals, and plants, as well as to any other living thing that might happen to operate in a different manner. It rules out psychistic explanations via the suppressed assumption that parts are necessarily material. According to Life_{MK}, anything, heartless or not, will count as alive as long as it gains nourishment from its environment, grows, and reproduces. In this case, Life_{MK} is meant to reduce life to a set of processes (life-functions) that are material by virtue of the arrangement-of-parts prescription.

Since the three life-functions are doing the work in Life_{MK}, we would expect them to be robustly specified and well grounded. If we are to rely on nutrition, growth and generation in order to determine what is alive and what is not, presumably we ought to be reasonably sure that nutrition, growth and generation are the right functions to use. Curiously, this is not what happens. MacKenzie tells us, 'I can only speculate as to *which* functions Descartes would include on his list' (1975: 8), and readily acknowledges that the nutrition–growth–generation list itself 'may be incorrect' (1975: 8, n. 16). Her point is that some particular list *will* do the job, and that it is not necessary to specify it accurately in order to show that Descartes's conception of life will look like Life_{MK} (with a better list substituted if, in fact, appropriate): 'a decision on precisely which functions Descartes would list is not necessary for a general understanding of Descartes' conception of life' (1975: 8, n. 16).

The first problem with Life_{MK} is that, with the life-functions doing the work, a decision on precisely which functions they are is entirely necessary for the concept to be meaningful. Without that decision, Life_{MK} becomes empty and arbitrary. With the list removed, Life_{MK} would read, 'x is alive if and only if x has an arrangement of parts which (together with motion) enables x to perform some set of functions'. This formulation would apply to any functioning machine; it only becomes specific to life when that set of functions is specified. Without the life-functions, Life_{MK} tells us nothing about life. In the absence of those functions, there is nothing for life to be reduced to. The second problem is that, as MacKenzie herself seems to be aware (1975: 8), there is no evidence that Descartes saw life in this way: he does not appeal to a set of functions as constitutive of life, and he does not seem to identify any particular function as constitutively necessary for life. As such, there is little to no scope for finding a set of functions in Descartes's work that can flesh out Life_{MK} and save it from vacuity.

3.2.4 Heat plus theogenic complexity

Ablondi broadly accepts Life_{MK}, but argues that a '*more basic*' criterion than a set of life-functions is available (1998: 183; emphasis in original). That more basic criterion is complexity. The main evidence for complexity as constitutive of life comes from the *Treatise on Man*:

> [w]e see clocks, artificial fountains, mills, and other such machines which, although only man-made, have the power to move of their own accord in many different ways. But I am supposing this machine [the human body] to be made by the hands of God, and so I think you may reasonably think it capable of a greater variety of movements than I could possibly imagine in it, and of exhibiting more artistry than I could possibly ascribe to it
>
> (CSM 1: 99; AT XI: 120).

In this passage, Descartes emphasises a difference between, on the one hand, manmade machines and, on the other, God-made machines capable of 'a greater variety of movements' than is even imaginable by man (or at least by Descartes) and that display a greater level of craftsmanship than Descartes could ever attribute to them. The message is that we humans know what it is to make machines, but our clocks and fountains are monumentally crude in comparison to the machine of the human body made by God. It is not much of a stretch to see this as a distinction in complexity between living and non-living machines: living machines are significantly more complex than non-living ones. Hence, following the general format of both Hall's and MacKenzie's versions, Ablondi formulates a concept of life for Descartes as follows:

> **Life**$_A$:= '(1) possession of an internal source of heat which serves as a principle of motion, and (2) having the complexity which only God can give a thing' (Ablondi 1998: 185).

Ablondi presumably includes (1) so as to rule out complex theogenic artefacts we would not want to classify as living, such as vortices. He does not spell this out explicitly, but he does note that (2) is not sufficient by itself (1998: 185). On Ablondi's reading, given Descartes's few remarks about heat as their principle of life, plants are included by (1) (1998: 183). (2) is necessary so as to exclude heat-driven manmade automata (1998: 183).

It is significant that the complexity stipulated by (2) is the kind of complexity that only God can provide. For Ablondi, the difference in complexity between living and non-living machines cannot be a difference of degree. The difference is between what humans are capable of producing and what God is capable of producing, and 'Descartes would be presuming clairvoyancy if he were to limit what human technology *ever could* do' (1998: 184) – i.e. if it were only a matter of degree, Descartes could not reasonably suppose that human technology would never be capable of reaching that degree. Consequently, while human bodies undoubtedly do have a higher degree of complexity than clocks, they must also have a different kind of complexity: a theogenic kind of complexity (1998: 184–5).

Ablondi himself recognises the problem with theogenic complexity:

> there must be some recognizable feature flowing from this complexity which enables us to conclude that we can't produce things that complex. To say this feature is 'life' is to beg the question; the complexity of the thing has to be identifiable *apart from its divine origin* if the claim is to function as a genuine criterion
>
> (Ablondi 1998: 184).

The trouble is that the mechanical complexity of the human body–machine exists entirely within the material world. The material world can accommodate different degrees of complexity perfectly well, in that we can give criteria for different degrees of complexity in material terms: more parts, smaller parts, more interactions between parts, etc. Material terms for the type of distinction in kind that Life$_A$ requires are elusive. Descartes's ontology, which allows nothing but 'shape, size, position and motion of particles of matter' (CSM 1: 279; AT VIIIA: 314) in extended substance does not permit ontologically distinct kinds of complexity. Ablondi notes that this problem is 'quite damaging' (1998: 185) to Life$_A$. His position appears to be that, although Life$_A$ is incoherent with respect to Descartes's system (i.e. it is not compatible with his

commitments elsewhere), textual evidence suggests that it is nevertheless the conception of life that Descartes held.

I do not think, however, that the textual evidence bears out this conclusion. The evidence that Ablondi cites is sparse. Besides the passage from *Man*, there is a brief passage from the *Discourse* (in the context of a summary of the then-unpublished *Man*): 'they will regard this body as a machine which, having been made by the hands of God, is incomparably better ordered than any machine that can be devised by man' (CSM 1: 139; AT VI: 56). There is also a letter to More in which Descartes remarks, 'since [. . .] people can make various automatons which move without thought, it seems reasonable that nature should even produce its own automatons, which are much more splendid than artificial ones – namely the animals' (5 February 1649; CSMK: 366; AT V: 277). This is not especially conclusive. In none of these passages does Descartes indicate that greater complexity is constitutive of life, rather than being merely a contingent feature of animal and human bodies.

In the letter to More, Descartes is arguing against animal intelligence and is attempting to deflect the objection that animal behaviour is too close to intelligent human behaviour to be thoughtless. His strategy is to show that animals are on a continuum with manmade automata, rather than with human thought. It should not be too surprising, he reminds More, if natural automata happen to be noticeably more 'splendid' (*praestantiora*) than their manmade equivalents. In summing up his argument, he explicitly tells More, '[p]lease note that I am speaking of thought, and not of life' (CSMK: 366; AT V: 278). Evidently, Descartes is not making the claim here that this splendidness is constitutive of life.

The passages from *Man* and the *Discourse* offer a little more support to Life_{A}, given their appeals to modality: the human body has 'a greater variety of movements than I *could possibly* imagine in it' and exhibits 'more artistry than I *could possibly* ascribe to it' (CSM 1: 99; AT XI: 120; my emphases); the human body is 'incomparably better ordered than any machine that *can* be devised by man' (CSM 1: 139; AT VI: 56; my emphasis). Taken literally, these comments do suggest that there is a kind of complexity that humans are incapable of ever producing, or even of ever imagining. It is not at all clear, however, that these comments should be taken literally. Descartes positions the *Treatise on Man* as a fable about a hypothetical mechanical human body that God could create.[10] Even if the conclusions of the treatise are ultimately meant to transfer to the actual world, the passage quoted above is from the opening of the extant text, where

[10] See the editors' note in CSM 1, p. 99, n. 1.

the rhetoric of the fable is still being set up. There is more here to suggest that the modal claims are rhetorical appeals to the greatness of God (especially given Descartes's fears about the Inquisition's possible reaction to his *World*, of which *Man* is a part[11]) than that they are principled commitments to an ontologically distinct kind of complexity. Indeed, in a letter to Mersenne, Descartes explicitly makes the point that, metaphysically, we should be able to build an artificial bird, even if, 'speaking as a physicist', we do not know how to make sufficiently intricate (*subtils*) springs (30 August 1640; AT III: 163–4): the problem is technical rather than ontological. Furthermore, whatever the difference in complexity between living and non-living machines, Descartes gives us no reason to suppose that greater complexity is a necessary condition in defining life.

Lastly, the evidence that Ablondi cites is entirely concerned with human and animal bodies. Descartes never suggests that plants are more complex than we could possibly imagine. Of course, it is plausible that, if asked, Descartes would have replied that this applies to plants as much as it does to animals. But Ablondi's justification for attributing a concept of life to Descartes that is incoherent with his wider system is the textual evidence. And even on the most generous reading of the textual evidence for the relevance of theogenic complexity, plants are absent. On a textual basis, then, it would not be unfair to say that Life_A excludes plants, and as such, by Ablondi's own criteria, does not even provide a viable concept of life.

Life_A attempts to conceptualise life by reducing it to two things in the material world: (1) heat as an underlying source of motion plus (2) theogenic complexity. Theogenic complexity, however, is not definable in terms of matter. Ablondi is aware of this but thinks the textual evidence warrants attributing a concept of life to Descartes that is incoherent with his system. The incoherence alone would be enough to call for suspicion, but, as we have seen, the textual evidence itself also turns out to provide little support for Life_A.

3.2.5 God's intentions

The treatments of life we have looked at so far have all tried to find a concept of life through reduction to something in the material world. There are good reasons for this approach, given Descartes's repeated insistence that life pertains to extended substance, and not to thinking substance. Detlefsen, however, recognises that extended substance does not have the resources to sustain a concept of life; the purely material

[11] See to Mersenne, end of November 1633 (AT I: 270–2).

conditions will have to be shored up by something extramaterial. For Detlefsen, the extramaterial ingredient lies in God's intentions. Bringing in God to confer life circumvents the lack of appropriate resources in matter.

Detlefsen broadly accepts Life_{MK}, but extends MacKenzie's list of life-functions to include reactivity to the environment as well as nutrition, growth, and generation, all subtended by another addition, a single overarching life-function: self-preservation (2016: 151). The following is, I think, a fair reconstruction of the concept of life that Detlefsen wants to allow Descartes, given her adjustments to Life_{MK}:

> **Life**$_{\text{D}}$:= x is alive if and only if x has an arrangement of parts which (together with motion) enables x to perform determinate life-functions (nutrition, growth, reproduction, and reactivity to the environment) for the sake of self-preservation.

Life_{D}, as Detlefsen herself is well aware (2016: 153, 167), introduces teleology to the definition. The obvious culprit to blame for this intrusion of teleology is Life_{D}'s reliance on self-preservation (because self-preservation is the end the life functions serve). Interestingly, Detlefsen does not see self-preservation as the source of the teleology. On the basis of the arguments from Shapiro 2003 and Brown 2012, she takes self-preservation to be fairly straightforwardly non-teleological (2016: 151–152, 154). Instead, she sees teleology entering the definition through the parts that perform the life-functions. Her example is the role of the mitral valve in Descartes's explanation of the heartbeat and its reliance on final causes (2016: 154). Consequently, even if self-preservation does escape teleology for Descartes (and I am somewhat less confident than Detlefsen that it does – see Ch. 6, §6.3, pp. 152–154), teleology still creeps into Life_{D} – if not from the top down through self-preservation itself, then from the bottom up through the life functions.

Life_{D}'s reliance on teleology is a problem. As Descartes keeps reminding us, whatever life is, it is entirely material (e.g. AT XI: 329–31; AT III: 566), and activity occurs in matter (extended substance) exclusively through mechanical means (AT VIIIA: 54, 314). As such, matter can have no intrinsic ends, and the only recourse for teleology is through extrinsic ends. For manmade artefacts, extrinsic ends are easy to come by: a hammer is for hammering because someone designed it with that purpose. Similarly, for natural bodies, extrinsic ends would have to come from God: a heart is for pumping blood because God designed it with that purpose.

But Descartes rules out access to God's intentions and excludes them from any role in natural philosophy[12]: we are limited, while 'the nature of God is immense, incomprehensible and infinite' and thus 'capable of countless things whose causes are beyond my knowledge. And for this reason alone I consider the customary search for final causes to be totally useless in physics; there is considerable rashness in thinking myself capable of investigating the impenetrable[13] purposes of God' (CSM II: 38–9; AT VII: 55).[14] Even if God did provide natural bodies with extrinsic ends, we could never know about it, making it useless for explaining the natural world. In this case, God's intentions can tell us nothing about what life is just because we have no way of knowing what his intentions are.

Detlefsen offers an ingenious potential solution to the problem of inscrutability: it does not matter if we cannot have certain knowledge of God's intentions, because a well-supported hypothesis about them will be sufficient to buttress Life_D. The trouble, as Detlefsen notes, is that even hypothesising about God's intentions is off limits for Cartesian natural philosophy:

> from Descartes' point of view, what I suggest above is illegitimate; we cannot use teleological explanations in so far as they are grounded in claims about God's purposes even as merely likely true beliefs in our explanations about the natural world, and so we cannot explain the teleological nature of (at least some) life activities by relying upon hypothetical claims to God's purposes as embodied in (at least some) living bodies
>
> (2016: 168).

Detlefsen argues that, without a concept of life, Descartes would have no way to identify living bodies as the subject of the life sciences, which 'would render incoherent' his work on biology (2016: 142). She takes Life_D to be that concept, but notes that Descartes maintains his metaphysical commitment to the inscrutability of God's intentions rather than adopting Life_D (2016: 168–69). Like Ablondi, Detlefsen upholds the need for a principled conception of life at the expense of the coherence of Descartes's larger system. Ablondi preserves Descartes's biology to the detriment of his

[12] Given Descartes's insistence that what we think of as the life of humans and animals pertains to extended substance, life pertains to natural philosophy (if there is such a thing as life).

[13] The use of 'impenetrable' here is an addition in the 1647 French translation approved by Descartes (AT XIa: 44).

[14] See also AT VII: 374–5 and AT VIIIa: 15–16.

metaphysics, in his claim that the textual evidence shows that Descartes holds Life_{A} despite its incompatibility with his ontology. Detlefsen preserves Descartes's metaphysics to the detriment of his biology: retaining the inscrutability of God's intentions in the light of Life_{D} makes Descartes's biology incoherent.

We do not need to force Descartes into such pessimistic outcomes. In the following section, I argue that the problem with Descartes's conception of life is not just with the proposed conceptions themselves – it is, first and foremost, with the expectation that he have one.

3.3 Descartes and the dissolution of life

3.3.1 Dissolution

The readings of Descartes discussed above have all focused on the need to attribute him with a principled means of distinguishing the living from the non-living. Each attempt to do so results in either an unworkable concept of life or a strong concept with destructive consequences. Life_{CH} was insufficient. Life_{H} was too exclusive to be viable. Life_{MK} was too arbitrary and resulted in vacuity. Both Life_{A} and Life_{D} ended up imposing incoherence on Descartes's philosophy. This is not an exhaustive list, and there may well be other possible answers to the question of what life is for Descartes. It seems likely, however, that there is something wrong with the question.

The trouble is that there is nowhere for the category of life to comfortably reside in Descartes's ontology. He strenuously rejects its presence in thinking substance. Whenever he mentions life, he attributes it to extended substance. But extended substance is homogeneous: there is no material difference between a human body and a grain mill. Attempts to identify aspects of matter that pertain specifically to living things lead to arbitrariness and fall apart swiftly (as with Life_{CH}, Life_{H} and Life_{MK}) precisely because there is nothing in matter that can make it belong to living things rather than non-living things. Matter is matter for Descartes, whether arranged into a clock or into an animal. If thought and matter are both ruled out, then seemingly the only recourse for a concept of life is in God's intentions. Unfortunately, God's intentions are off limits for Cartesian natural philosophy: if that is where the definition of life resides, then it is forever hopelessly out of reach. It seems that wherever we look for the category of life in Descartes's ontology, we will reach an impasse.

The solution to the above problems is to not look for a principled concept of life. Descartes provides no general, rigorous definition of life because he does not have one. And it is not that he has no such concept because his philosophy is incoherent. It is because he does not need one: a concept of life as such plays no role in his biology or in his wider system, and its absence is entirely without detriment. Descartes's aim is not to provide a concept of life, but to explain life away. Hall makes the point that 'the explanations [Descartes] developed were corpuscularized, nonpsychistic versions of psychistic explanations put forth earlier by others' (Hall 1970: 63; italics removed).[15] His method in biology was not to produce 'explanations of fact' but explanations of 'other peoples' explanations (often dismembered and reassembled with various additions and deletions)' (1970: 64; italics removed).[16] The evidence bears this out. Descartes takes on the Aristotelian psychistic conception of life, and he indeed dismembers and reassembles it differently, with additions and deletions. In other words, he breaks the Aristotelian conception apart and demonstrates piecemeal how each of the functions it performs can be produced by nonpyschistic, mechanical interactions of matter. Nutrition, for Descartes, is identical to the accretion of blood particles in the pores of the organs (AT XI: 245–52). The animation of the body is driven by the heat of the heart and the various mechanical processes (respiration, circulation, digestion, etc.) that feed into it (*Passions* 1:8; AT XI, 333). It is through the explanation of the various phenomena traditionally associated with life that Descartes deals with life.

In Cartesian reduction, there is an analytic step followed by a synthetic step. The phenomenon at hand is broken down into its most basic parts, and then the original phenomenon is reconstructed from those basic parts (AT X: 379–87). A reductive explanation is able to synthesise the phenomenon it explains from the parts to which the phenomenon has been reduced. This is precisely what Descartes does with nutrition, animation, sensation, etc. If nutrition is explained as accretion of blood particles in organ pores, you have nutrition exactly when you have accretion of blood particles in organ pores. This is not, however, what Descartes does with life. When it comes to life, as the previous sections of this chapter have shown, the category cannot be reconstituted from the material, mechanical explanations of the life-phenomena. As

[15] This is perhaps a good way of understanding Descartes's defensive remark to Plempius, on having been accused of merely replicating Aristotle's account of the cause of the heartbeat: 'If two people arrive at the same place, the one taking the right road, the other the wrong one, we ought not to think that the former is following in the footsteps of the latter' (15 February 1638; CSMK: 80; AT I: 522).

[16] This is not to suggest that Descartes made no innovations. Hall's point is that the problems Descartes addressed were taken from the established treatments of biology, rather than directly from nature; his answers to those problems were (largely) his own.

we have seen, if we have cardiac heat, nutrition, etc., we still cannot reliably distinguish living things from non-living things. Descartes does perform the analytic step for life: as outlined above, he reduces everything that the Aristotelian conception associated with life to mechanical interactions of matter. But he does not perform the synthetic step (because he cannot). In this sense, Descartes is not a reductionist about life but a strict eliminativist. In the process of analysing life-phenomena, Descartes simply dissolves the category of life itself.

3.3.2 Objection: Descartes talks about life

If Descartes dissolves the category of life, then why does he continue to talk about life in all the ways outlined in §3.1? He is certainly not averse to using the term, and his use of it does seem to be meaningful. There are several possible replies to this objection. One is to suggest that, compared to the loss of the coherence of either metaphysics or biology that strong reductionist positions about Descartes's conception of life seem to result in, the occasional use of a term with no strict, principled definition seems like a minor infraction, especially if nothing of much significance rests on it (see §3.3.3 below). This is a fairly reasonable response, but it is not particularly satisfying. A better variation would be to claim that 'life', in this context, is something like a folk term. Just as a strict physicalist might sometimes find it more convenient to talk about desires rather than the specific brain-states desires reduce down to, so Descartes finds it more convenient to talk about a living animal rather than a non-manmade automaton with whatever attributes and behaviours happen to be relevant to the particular automaton in question.[17]

A stronger variation on this latter response would point out that 'life' is not just a folk term for Descartes: it is an Aristotelian term. In almost every instance where Descartes refers to life, he is explicitly trying to demonstrate the distinction between his own biology and Aristotelian psychistic biology. When Descartes brings up life in both the *Treatise on Man* and the *Discourse*, it is expressly to point out the redundancy of vegetative and sensitive souls (AT XI: 202; AT VI:45–6). When he does the same in articles five and six of *The Passions of the Soul*, it is to show that taking the soul to animate the body (i.e. the Aristotelian position) is a 'very serious error' (CSM I: 329; AT XI: 330). Similarly, the discussion of the heartbeat in the correspondence with Plempius is in response to Aristotelian objections from both Plempius and (initially) Fromondus (AT I: 413–6; AT I: 521–34; and especially AT II: 62–9). Descartes does not, then, use the

[17] Wolfe (2010: 204) discusses instrumental uses of the term 'organism' in modern biology in much the same way.

term 'life' because it is well-defined in the Cartesian system but because it is well-defined in the Aristotelian system – and his aim when using the term is to show that all the phenomena an Aristotelian will associate with life are mechanistically explicable.[18]

3.3.3 Objection: Descartes's biology needs a principled concept of life

One of Detlefsen's major concerns with respect to Descartes's concept of life is that, without a principled concept, Descartes could not identify life; and without life, he could have no life sciences, despite his deep commitment to anatomy, physiology and medicine (2016: 142). It is this concern that, given Life_{D}, leads Detlefsen to the pessimistic conclusion that Descartes's life sciences are bankrupt (§3.2.5 above). If Descartes does indeed require a principled concept of life to demarcate the discipline of biology, then the dissolutionist reading will also lead Descartes's project into incoherence.

However, Descartes's concerns are not those of modern life sciences. Unlike today's science, Descartes had no particular need to protect the disciplinary unity of general biology. For Descartes, little would be at risk if the 'life sciences' were to entirely collapse into physics. Nor did he have any need for a biology capable of dealing with all living things, given that he was always perfectly clear that his ultimate aim was (human[19]) medicine (AT IV: 329; AT VI: 62–3; AT VI: 78).[20] Consequently, it is not life itself that gives unity to this 'aspect of his life as a working natural philosopher' (Detlefsen 2016: 142); it is the potential of physiology and anatomy for the medical treatment of humans. And since humans are not just bodies but unions of soul and body, teleology is not a problem for (human) medicine: medicine can legitimately be an end for the Cartesian natural philosopher's pursuit of biology. Life itself, then, is not necessary for constituting the discipline of biology for Descartes. Consequently, dissolutionism about life is not a problem for Cartesian biology.

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[18] Somewhat similar aims crop up throughout Descartes's natural philosophy, of course. In the explanation of fire in the *World*, e.g., Descartes makes a point of how his mechanics can account for just as much as an Aristotelian 'form of fire' and 'quality of heat', while being both more explanatory and less ontologically extravagant (CSM I: 83; AT XI: 7–9).

[19] Descartes is famously antipathetic towards animal welfare. Veterinary medicine would be a literal oxymoron for him. See to More, 5 February 1649 (AT V: 278–9). But cf. Harrison 1992.

[20] On the centrality of medicine in Descartes's philosophy, see especially Aucante 2006, and Manning's (2007) extended review of the same.

3.4 Conclusion

Initially, there appear to be good reasons for taking Descartes to be a reductionist about life, and for thinking that there is a well-defined, principled concept of life to be found in his philosophy. However, attempts to find such a concept result in insufficiency and inviability ($Life_{CH}$, $Life_{H}$) or arbitrariness ($Life_{MK}$), or they push Descartes's system into incoherence ($Life_{A}$, $Life_{D}$). This is because there is nothing in Descartes's ontology for life to be reduced to: it is not a species of thought, extended substance lacks the resources for distinguishing living from non-living, and God's intentions are inscrutable. The alternative is to relinquish the requirement for a well-defined, principled concept of life. Rather than being a reductionist about life, Descartes dissolves the category. The dissolutionist reading makes good sense of Descartes's unwillingness to produce, or even discuss, a general definition of life, and, unlike the alternatives, it appears to have no negative repercussions for Descartes's system.

Part 2

Nonreductionism in Descartes's epistemology and metaphysics

Chapter 4

The priority of the union in Descartes's epistemology and metaphysics

4.1 Introduction

The union of mind and body is a perennial problem in Descartes scholarship. The curious thing is that Descartes himself never treated it as though it were much of an issue at all, even when pressed on the point by correspondents as capable and forthright as Princess Elisabeth and Gassendi. My aim in this chapter is to give a reading of Descartes's treatment of the union that does justice to his indifference to what so many have taken to be the deepest flaw in his system. In response to demands that he explain how two mutually incompatible substances can interact, his claim is that each of us already knows that our mind and body are united and that no further explanation is needed (or some variation thereof). My position here is that Descartes means exactly what he says in his treatment of the union, and that this has knock-on consequences for our understanding of his epistemology, and maybe even of his metaphysics.

I argue that the union of mind and body cannot be explained within the terms of Descartes's dualist system, but that this is not a problem for Descartes. It is not a problem because he addresses it via other means. As Descartes claims, we understand the union through sensation, rather than through the metaphysics of substance interaction. This, I argue, constitutes an epistemology that pertains to the union and that is separate from the well-known epistemology that pertains to the dualism. The

epistemological side of my reading is largely in agreement with Simmons (manuscript), who argues that Descartes's treatment of the union is part of a phenomenology of sensation. I push the reading a little further here, by arguing that there is a true, viable epistemology of the union (this is also covered in Ch. 6), and that it has a certain priority over the epistemology of Descartes's dualist system. And I differ from Simmons entirely in taking there to be an implicit metaphysics of the union.

The aim of the chapter is to give a reading that makes sense of Descartes's seemingly dismissive treatment of the problem of the union. Its objective is not to establish what Descartes really thought about the union, but (first) to reconstruct an epistemology that would allow Descartes to reach the conclusions he did with respect to the union. Second, it reconstructs the metaphysics implied by his conclusions about the union.[1] Consequently, there are two parts to the chapter. The first (§§4.2–4.3) argues that the union makes for an epistemic gap in Descartes's dualism[2]: the reason he will not, and cannot, explain it in the way he explains various properties of mind and body separately is that the union is indefinable in the terms of his dualism. What this tells us is that Descartes does not expect his dualist system to account for every single feature of the world: the union is one exception (there may be others). The second part of the chapter (§§4.4–4.5) extends this analysis to metaphysics. The idea is that, because the dualist metaphysics does not cover the union, Descartes's account of the union contains an implicit metaphysics that does. The metaphysical claim is more contentious than the epistemological claim, and the rest of this dissertation is agnostic about it (while some parts of the dissertation (Chs 5 and 6) do depend on the epistemological claim).

What this chapter proposes is that Descartes has a separate, implicit epistemology and metaphysics for the union, which he invokes at various points, in addition to the familiar dualist epistemology and metaphysics. There is some precedent for the epistemological side of this reading: in a recent paper, Brown suggests that whether we understand ourselves to be unions or mind 'depends on which explanatory [. . .] context

[1] Simmons (manuscript: 12) argues that it is 'wrongheaded' to attempt to provide a metaphysical account of the union – and, if we understand Descartes's metaphysics to be nothing but the metaphysics of the dualist system, I agree entirely. The point I make here, though, is that Cartesian metaphysics is not restricted to the framework of the dualist system: there is another, separate metaphysical framework implicit in his treatment of the union.

[2] *Cf.* Alanen: Descartes's treatment of the union 'can be seen [. . .] as a recognition of the limits of rational knowledge and explanation' (1996: 14).

we are in' (Brown 2014: 255); here, I interpret Descartes as switching between different epistemological contexts (which I refer to in §4.3 as 'domains of conceivability').

I am also going to argue that the epistemology of the union is the 'natural' human state for Descartes, and that his dualism is a derivation from it. The obvious objection here would be that, even if Descartes does have a distinct epistemology and metaphysics of the union, the whole point of his project is to supplant our 'natural' state of epistemic error. In that case, the epistemology and metaphysics of the union would be overridden, and whatever there might be to say about them would ultimately be irrelevant. Another way to put this would be to ask why we should care about some separate epistemology and metaphysics of the union when Descartes already has the fully-worked out dualist system. The trouble with this objection – and the reason we do have to care about the epistemology and metaphysics of the union – is that Descartes requires, and makes use of, the union within his dualist project, when his dualist epistemology and metaphysics cannot account for the union at all (see §4.2). He needs at least the separate epistemology of the union to deal with the presence of the union. So the dualist system can never fully supplant the epistemology (and possible the metaphysics) of the union. The latter always remain, as a kind of import, within Descartes's dualist system.

This is why, if there is an epistemology and a metaphysics particular to the union, we need to understand what they are – that is, because they are indispensable for Descartes. The difficult part is that he says very little explicit about how things work for the union itself. There is a good reason for this: Descartes claims that we understand the union naturally and unproblematically, while the dualism is a harder sell that takes considerable work and persuasion to be accepted; understandably, then, as he tells us, he has written far more on the latter than on the former (AT iii: 664–5). This is one of at least two reasons why it might look as though Descartes has no epistemology or metaphysics of the union[3] – as if he leaves the union forever vague and underexamined. The other reason is that we expect Cartesian metaphysics and epistemology to be given in the terms of his dualist system. When those terms are not present, it might well look as though there is nothing metaphysical or epistemological there at all. What this chapter aims to show is that there is indeed an epistemology of the union, and that there is perhaps also a metaphysics of the union. But they are an implicit epistemology and an implicit metaphysics, and they need to be teased out of the scattered remarks about the union that Descartes does make.

[3] See (Simmons 2011: 7).

The argument proceeds as follows. I address the epistemology of the union first, since Descartes is somewhat more explicit about it, and show that the notion of the union is, for humans, the most fundamental in Descartes's philosophy (§§4.2–4.3). Second, I show that, in the metaphysics that pertains to the union, the union ends up ontologically more fundamental than, or ontologically prior to, the dualism of mind and body (§4.4). I then give two conclusions. The first (§4.5) shows how the union-priority reading dissolves the problem of mind–body interaction (because it does away with the problem). The second (§4.6) argues that this reading makes Descartes a nonreductionist in the epistemology and metaphysics of the union (because, on this interpretation, the union is not reducible to mind and body).

4.2 The union is the 'most primitive' notion

4.2.1 Primitive notions and the union

Descartes's most extensive treatment of the union is in his correspondence with Elisabeth. Elisabeth's stated motivation for writing to Descartes in the first place is to raise the problem of mind–body interaction (Bohemia and Descartes 2007: 91; AT iii: 661). In his first reply, Descartes addresses the problem in terms of primitive notions, of which three in particular are relevant: thought, extension, and union.

> First I consider that there are in us certain primitive notions which are as it were the patterns on the basis of which we form all our other conceptions. There are very few such notions. First, there are the most general – those of being, number, duration, etc. – which apply to everything we can conceive. Then, as regards body in particular, we have only the notion of extension, which entails the notions of shape and motion; and as regards the soul on its own, we have only the notion of thought, which includes the perceptions of the intellect and the inclinations of the will. Lastly, as regards the soul and the body together, we have only the notion of their union, on which depends our notion of the soul's power to move the body, and the body's power to act on the soul and cause its sensations and passions
>
> (CSMK: 218; AT iii: 665).

That mind and body should be primitive notions is something we would expect. Descartes's standard ontology is dualist, and everything in the material world is a modification of extension, while everything in the mind is a modification of thought. Necessarily, then, when we conceive of something material, we conceive of it through extension, and when we conceive of something mental, we conceive of it through

thought.[4] So everything material comes down to matter itself, and everything mental to mind itself. Since Descartes's (standard) ontology contains nothing but thought and extension, our only options for conceiving of thought and extension are thought and extension themselves. And because substances can depend only on themselves[5], extension can tell us nothing about thought, and thought nothing about extension. So we cannot conceive of the one through the other, and thought and extension must be primitive.

Treating the union as a primitive notion as well, though, seems counterintuitive (at least under the aegis of standard accounts of Descartes's ontology). After all, the union is meant to be a union *of* mind and body. On the face of things, it would seem perfectly natural to take the union to be, if anything, a composite notion, conceived through both thought and extension. Given Descartes's famous dualism, given his famous ontological and explanatory parsimony, and given that the union is precisely a union of his two fundamental substances, we would reasonably expect it to be conceived through those two substances. Elisabeth too expects an explanation of the union in terms of thought and extension. This is presumably why the problem gets posed as a problem of mind–body interaction, rather than a problem of the union itself.

So, it would be consistent with his wider commitments for Descartes to characterise the union as a composite notion, but he makes it a primitive notion instead. Why this ultimately has to be his position is fairly straightforward. If extension can tell us nothing about thought, and thought can tell us nothing about extension, then neither thought nor extension can tell us anything about their union. This is because the union has properties that are present in neither the mind nor the body taken by themselves.[6] So whatever we want to know about the union is not going to be conceivable through the notions of either thought or extension. And it cannot be conceivable though the notions of *both* thought and extension simultaneously either, just because thought and extension are necessarily conceptually isolated from each other: the notion of both thought and extension simultaneously is not covered by the individual notions of

[4] See Nolan (1997: 130).

[5] And, in the case of created substances, God (*Principles* 1/52–2).

[6] On properties specific to the union, see (Simmons 2011: 9–10) and (Brown 2014: 248), who writes, 'the special subject of these irreducible modes is not one that Descartes can draw from his official ontology of basic substances, and hence he needs to conceive of the union as *sui generis*'.

thought and extension.[7] Put another way, to appeal to both thought and extension simultaneously is just to restate the problem of the union itself.

Necessarily, then, the union needs a notion of its own. Neither thought nor extension is going to do the job. And, because the other primitive notions ('being, number, duration, etc.') that Descartes mentions 'apply to everything we can conceive', they are not going to pick out anything specific to the union. So the only means we have of conceiving of the soul and the body together (or of both thought and extension simultaneously) is the notion of their union itself. And it is on this notion that Descartes claims our conception of mind–body interaction depends. Crucially, and against initial intuitions, our conception of mind–body interaction does not depend at all on on our notions of mind and body. This is in no way a trivial result: it means that thought and extension, which are supposed to be the fundamental elements of Descartes's philosophy, can tell tell us nothing at all about the union.

This is a problem for Descartes's system, specifically for his dualism and his reductionism. The world is supposed to consist of nothing but thinking substance and extended substance (and God), and everything within in it is supposed to be epistemically and ontologically reducible to thought or extension. But there is something in the world that is neither a thinking substance nor an extended substance, and that is not reducible to either. This is not just a matter of epistemic uncertainty. Descartes's claim is explicitly not that he simply does not yet have a good explanation of the union in terms of thought or extension. His claim is there can be no explanation of the union in terms of thought or extension, for just the reasons covered above. The union requires a primitive notion of its own.

So, Descartes is explicit that the union exists and can only be conceived through a primitive notion of its own. The outcome of this is that, if Descartes's philosophy is, fundamentally, the dualist system we take it to be, then it contains something it necessarily cannot explain: if the dualist system *is* Descartes's philosophy, then the union is necessarily indefinable within Descartes's philosophy. It seems that we have to conclude either that Descartes's system is traditionally dualist but fails in a highly non-trivial way, or that it is (in one way or another) not dualist. My interest here is in the

[7] This is evidenced by the existence of properties particular to the union. As Simmons puts it, 'Descartes himself insists that a real human being is nothing like an angel in a machine (or and angel in an animal). He takes the presence of sensations, appetites, and passions to be decisive evidence that the human being consists in some kind of a union of mind and body, and not in a mere aggregation of them' (Simmons manuscript: 10–1; see also Simmons manuscript: 18).

second option.

4.2.2 The notion of union is prior to the notions of mind and body

If my approach is to deny dualism in some way, then the obvious, and established (if still controversial), route to take would be trialism. That is not the route I am going to take, for both metaphysical and epistemological reasons. Metaphysically, trialism assumes that the ontological categories that apply to the dualist system (namely, substance) can also be applied to the union. It is not obvious that they can (see (Brown 2014: 255)).[8] Epistemologically, trialism treats the union[9] as a primitive notion on a par with the notions of thought and extension; my position is that the union has priority over thought and extension. I take it that the notions of thought and extension are, in a certain sense, secondary to the notion of union. This is a tricky route to take, for at least two reasons. First, the textual evidence makes it seem uncomfortably clear that, if Descartes is serious about his doctrine of primitive notions, he means each to be incompatible and incomparable with any other, thanks to their conceptual isolation. Hoping to establish priority between incompatibles seems quixotic. Second, giving the notion of the union priority over the notions of thought and extension seems, if anything, more incongruous with Descartes's system as we know it than does allowing an inexplicable union into a dualist system (at least initially).

I'll leave the second problem for §§4.3–4.5 (briefly, it's not as incongruous as it sounds, and it neatly solves some problems that are otherwise fairly intractable). In the current section, I am going to show that, for humans, the notion of the union must be epistemically prior to the notions of thought and extension. Then (in §4.3, we'll solve the first problem by showing that the priority comes not from relations between the notions themselves (of which there cannot be any), but from an equivocation between domains of conceivability that Descartes undergoes in his reply to Elisabeth. This is because, although the union is not conceivable in terms of the notions of thought and/or extension, thought and extension are both perfectly conceivable in terms of the union. And it is not just that thought and extension are *in principle* conceivable in terms of the union; it is that Descartes does in practice derive thought and extension from

[8] I agree with Hoffman that 'it seems implausible to read [Descartes] as suggesting [. . .] that the union of mind and body should be considered to be an attribute, that is, something constituting the nature or essence of a substance' but disagree that Descartes's treatment of the union constitutes a hylomorphic account (2008: 392) – for the reasons set out in §§4.3 and 4.4, Descartes's account of the union requires treatment in terms of a separate, subjective metaphysics.

[9] In Cottingham's original paper on trialism, he refers to sensation rather than the union (Cottingham 1985).

the union (that derivation is notably represented in the structure of the *Meditations*). Indeed, if my reading is correct, for humans, the notions of thought and extension are necessarily derived from the union.[10]

When Descartes introduces the primitive notions in the letter to Elisabeth, he explains that 'we go wrong if we try to explain one of these notions by another, for since they are primitive notions, each of them can be understood [*entenduë*] only through itself' (CSMK: 218; AT iii: 666). This works, for the reasons covered above, for thought and extension: the notion of thought is not going to be able to tell us anything about extension, and vice versa. It also works for trying to understand the union through the notions of thought and/or extension: neither thought nor extension, nor any combination thereof, will be able to tell us anything about the union, and this is exactly our original problem. But does it also work for understanding thought and extension through the notion of the union? That seems less convincing. If mind and body are two sides of the union, which they are, and if we have a primitive notion of the union, which we do, then, in principle, what prevents our being able to understand both mind and body through the union? Nothing, as far as I can see. Conversely, if we had only a primitive notion of mind and a primitive notion of body, then we would never be able to understand the union through them (again, for all the reasons above). There are at least three ways to argue this, and those arguments follow in the next few sections. The first two are my major arguments; the third is somewhat supplementary (but has far-reaching implications).

4.2.2.1 Argument from containment

In his cosmological argument for the existence of God, Descartes relies on the doctrine that a cause (or dependency) must contain at least as much as its effect (or dependent):

> it is manifest by the natural light that there must be at least as much in the efficient and total cause as in the effect of that cause. For where, I ask, could the effect get its reality from, if not from the cause? And how could the cause give it to the effect

[10] The derivation involved is not a logical derivation: it is not the derivation of epistemic justification from well-founded grounds. It is a causal derivation of the notion itself, rather than of its justification (*Cf.* Demos (1934) on 'biological derivation' – although Demos still conflates the justification of a notion with the notion itself). This is much like the derivation of a metal from its ore: in a world where iron is only found naturally as iron oxide, pure iron can only be derived from its oxide; this is separate from the justification of iron as an element. Similarly, in the world of the union (i.e. the subjective world of any human), the notions of thought and extension can only be derived from the notion of union; and this is separate from their intellectual justification as independent substances.

> unless it possessed it? It follows from this both that something cannot arise from nothing, and also that what is more perfect – that is, contains in itself more reality – cannot arise from what is less perfect. [. . .] A stone, for example, which previously did not exist, cannot begin to exist unless it is produced by something which contains, either formally or eminently everything to be found in the stone; similarly, heat cannot be produced in an object which was not previously hot, except by something of at least the same order <degree or kind>[11] of perfection as heat, and so on.
>
> (*Meditations* 2; CSM ii: 28; AT vii: 40–1).

There has to be some source for the effect already contained within its cause. This is why, as Descartes explains it here, something cannot come from nothing. In Descartes's example, a stone can only be produced by something that already contains stone, or that contains the components of stone. This containment can be formal, in which case the cause literally contains what is in the effect. Or it can be eminent, in which case the cause contains what is in the effect in some higher form (which explains how God could have created a world that includes divisible matter while being indivisible himself[12]). So, *y* can be derived from *x* just in case *y* contains nothing that *x* does not. Consequently, if *y* contains something that *x* does not, then *y* cannot have been derived from *x*.

Applying this doctrine to the primitive notions, we see that the notion of the union contains more than the notion of thought does: the union necessarily also involves body. And since the union also necessarily involves mind, the notion of the union contains more than the notion of extension does. So the notion of the union cannot be derived from the notion of thought and cannot be derived from the notion of extension (this, of course, is another version of the arguments covered above). But, crucially, that does not seem to be true of the converse. The union is a union of both thought and extension. With that in mind, is there anything in the notion of thought that is not already contained in the notion of the union? And is there anything in the notion of extension not already in that of the union? The answer, in both cases, seems to be no.

If I am right here, then the notions of both thought and extension are derivable from the notion of the union (and not vice versa). In itself, this does not mean that the

[11] Insertions in angle brackets are included in CSM and are from the 1647 French translation of the *Meditations*, which Descartes had approved.

[12] The extent which that is a convincing argument is questionable, of course, but that's beside the point here.

notions of thought and extension *are* in fact derived from the notion of union, of course. The individual notions could still be derived independently of the union (presumably, from God; that is, as innate ideas bestowed on us by God). But they are nevertheless derivable from the union. It does not seem like a stretch to conclude that one-way derivability is a (weak) form of epistemic priority. And, if so, then the notion of the union is prior to the notions of both thought and extension.

4.2.2.2 Argument from the order of the Meditations

The basic structure of the *Meditations* is, broadly speaking, analysis followed by synthesis (AT vii: 155; Williams 1978: 33). The method of doubt is what prompts the analysis, stripping away the familiar world to leave us with only the indubitable truths. Our familiar world then gets built back up on top of these truths. The standard reading of the *Meditations* privileges the indubitable truths. They are, explicitly, meant to be the foundations of Descartes's entire philosophy (on the reading given here, of course, they are only the foundations of a restricted part of his philosophy): Descartes opens Meditation One by asserting the need 'to demolish everything completely and start again right from the foundations if I wanted to establish anything at all in the sciences that was stable and likely to last' (CSM ii: 12; AT vii: 17). So, given the truths of the cogito and the existence of God, Descartes is supposed to be able to derive true knowledge of the world. The cogito itself shows that there is thought, while the existence of God ensures that there is extension.

What concerns us here, however, are the prerequisites for the analysis that leads to the indubitable truths. We know that we need the cogito in order to prove the existence of God, because each of Descartes's proofs relies on an idea of God that inheres in some thinking subject.[13] So the cogito is a prerequisite for the proof of God's existence. And so the cogito is (logically) prior to the proof of God's existence. Given that, we can put the proof of God's existence to one side and focus on the cogito. What we want to know are the conditions required for deriving the 'I am, I exist' that is supposed to hold up the whole edifice. On this face of it, this might seem like a strange thing to look for. The entire point of the cogito is that it has no dependencies beyond itself, precisely because it is its own grounds – that is what makes it indubitable. If that's so, it should have no prerequisites.

[13] Even the argument from existence as a perfection relies first on *my* conceiving of God as perfect (AT vii: 65).

However, in the Second Replies, Descartes makes very explicit that the order of the *Meditations* is in no way accidental:

> The order consists simply in this. The items which are put forward first must be known entirely without the aid of what comes later; and the remaining items must be arranged in such a way that their demonstration depends solely on what has gone before. I did try to follow this order very carefully in my *Meditations*
>
> (CSM ii: 110; AT vii: 155).

What's more, Descartes is clear that we cannot skip stages in the order of the *Meditations*: he goes on to point out that 'if [the reader] fails to attend even to the smallest point, he will not see the necessity of the conclusion' (CSM ii: 110; AT vii: 156). And since the cogito does not fall at the beginning (it has to wait for Meditation Two), it must be that a prior stage is necessary for getting to the cogito.

What is prior to the cogito is doubt: before being able to reach a stable foundation, the Meditator has to 'demolish everything completely' (CSM ii: 12; AT vii: 17). If we are to take Descartes's comments in the Second Replies seriously, then this demolition stage is a necessary prerequisite for the cogito. We cannot get to the cogito without going through doubt first. And what doubt works on, in the *Meditations*, is sensation and beliefs derived from sensation:

> Once the foundations of a building are undermined, anything built on them collapses of its own accord; so I will go straight for the basic principles on which all my former beliefs rested.
>
> Whatever I have up till now accepted as most true I have acquired either from the senses [*a sensibus*] or through the senses [*per sensus*]
>
> (CSM ii: 12; AT vii: 18).

The old foundations that the Meditator has to destroy before being able to reach the cogito are the foundations of the senses. And, as we know from Meditation Six, the correspondence with Elisabeth, and so on, the senses are the domain of the union (the Meditator might not know that term at this point, but we do).[14] So the union is a necessary prerequisite for the cogito, and hence also for the proof of God's existence. And that makes the union a necessary prerequisite for the notions of both thought and extension, thus giving it priority over them.

[14] See (Brown 2014: 245–6) and p. 92 below.

We might want to object at this point that to bring up the union before its introduction in Meditation Six is to ignore the order of the *Meditations* – even more so given that my argument here relies on the order of the *Meditations*. I have two responses to this. First, it is true that, at any given point in the *Meditations*, all that is available to the Meditator is what has been established up to that point, and not 'what comes later' (CSM ii: 110; AT vii: 155). But that can only be the case *subsequent to doubt*. At the very beginning, necessarily, everything is available. It is precisely because everything is available that doubt is needed, in order to 'hold back [. . .] assent from opinions which are not completely certain and indubitable' (CSM ii: 12; AT vii: 18). Second, my argument here does not take place within the *Meditations* project. Consequently, while the Meditator needs to follow the order of the *Meditations* (and so must start from the union in order to get to the cogito), this argument does not. My concern is with what is prior to the *Meditations* project (and the name Descartes gives us for what's prior to it is 'the union').

We might also want to object that the need for doubt is only contingent on our own confusion. This would mean that doubt is not a *necessary* prerequisite to the cogito, but only a contingent prerequisite. The thought here is that doubt is only needed to get rid of old prejudices, and that if we were, somehow, naturally the right kind of thinker, free of ingrained prejudices, we would be able to skip doubt and start straightaway with the cogito. The problem with this approach is that, for Descartes, none of us could ever naturally be the 'right' kind of thinker for skipping doubt. This is Descartes's opening description of the nature of the union in the *Meditations*:

> There is nothing that my own nature teaches me more vividly [*expresse*] than that I have a body, and that when I feel pain there is something wrong with the body, and that when I am hungry or thirsty the body needs food and drink, and so on. [. . .]
>
> Nature also teaches me, by these sensations of pain, hunger, thirst and so on, that I am not merely present in my body as a sailor is present in a ship, but that I am very closely joined and, as it were, intermingled with it, so that I and the body form a unit. [. . .] [T]hese sensations of hunger, thirst, pain and so on are nothing but confused [*confusi*] modes of thinking which arise from the union and, as it were, intermingling of the mind with the body
>
> (CSM ii: 56; {Descartes, 1996, 7, Œuvres de Descartes@80–1}).

Thus, confusion (in a certain sense) is the nature of every human, as a union of mind and body.[15] As such, our confusion is necessary, not contingent.[16] As unions, we are

[15] This would not be the case for disembodied minds; humans, though, are unions. See Simmons (2011: 3ff.).

incapable of naturally being the kind of thinker that can skip straight to the cogito. Instead, we necessarily have to go through an active process of doubt in order to leave our natural confusion behind and reach the cogito. This means that, for any human, doubt really is a necessary prerequisite for the cogito. By the same token, the union itself is also a necessary prerequisite for the cogito.

So, necessarily, we cannot get to the cogito, or to the proof of God's existence, without starting from the union. And our notions of thought and extension depend on the cogito and God's existence respectively. This does not yet mean, however, that our notions of thought and extension are derived from the union. To show that they are derived from the union, we need to look at where those notions come from, within the order of the *Meditations*.

In the case of thought, the notion is derived from my notion of myself. In Meditation Two, Descartes starts from the pre-doubt conception: 'What then did I formerly think I was? A man' (CSM ii: 17; AT vii: 25). As Descartes will later establish, a 'man' in the sense he formerly took himself to be is a union (AT vii: 81; AT vii: 88). Back in Meditation Two, he then proceeds through an analysis of the union, stripping it of anything that can be doubted (via a version of the malicious demon argument), until he gets to thought ('this alone is inseparable from me' (CSM ii: 18; AT vii: 27)). It is from this that the Meditator establishes that s/he is a thinking substance, and thus derives the notion of thought itself (AT vii: 28). So, within the order of the *Meditations*, the notion of thought is derived from an analysis of the union. This is important: in §4.2.2.1, we established that the notion of thought is *in principle* derivable from the union; here, we see that it is *in fact* derived from the union.

In the case of the notion of extension, things are slightly more complicated. The notion is first brought back in for the Meditator at the end of Meditation Two, with the wax example (although somewhat obliquely, in that it is not referred to as 'extension', 'matter', etc. at that point). But the confirmation of the existence of extension, and hence the Meditator's affirmation of the notion, does not take place until Meditation Six. With the wax example, Descartes starts, again, with a pre-doubt conception ('Let us consider the things which people commonly think they understand most distinctly of all; that is, the bodies which we touch and see' (CSM ii: 20; AT vii: 30)). He picks out a piece of beeswax and runs through another process of analysis on it, eliminating all its properties until we are left with nothing but extension: 'I would not be making a correct judgement about the nature of wax unless I believed it capable

[16] On human nature and the union, see (Simmons 2011: 8).

of being extended' (CSM ii: 21; AT vii: 31). Thus, here, in the same way, the notion of extension is derived from an analysis of the union.

The approach in Meditation Six is similar. Descartes begins from sensation, with the stated aim of seeing 'whether the things which are perceived by means of that mode of thinking which I call "sensory perception" provide me with any sure argument for the existence of corporeal things' (CSM ii: 51; AT vii: 74). The analytic process that follows this time is longer and more involved, addressing everything that (pre-doubt) we take to be perceived sensorily, and the reasons for doubting it. This analysis too eventually reaches a clear and distinct conception of corporeal things as extension (AT vii: 79). And, because that conception excludes thought from corporeal things, our ideas of them cannot be the products of our own minds (since there cannot be more in the effect than is in the cause). This means that they need another source. All the Meditator has allowed back in at this point is his/her own mind and God. But we do experience ideas of corporeal things as coming from real corporeal things. Consequently, 'I do not see how God could be understood to be anything but a deceiver if the ideas were transmitted from a source other than corporeal things'; and since God cannot be a deceiver, he cannot be the source of our ideas of corporeal things, and thus '[i]t follows that corporeal things exist' (CSM ii: 55; AT vii: 80). It is in this way that extension gets to be affirmed as real by the Meditator, and so gets to take its place in the Cartesian ontology.

But, as we have seen, in both Meditation Two and Meditation Six, the notion of extension is derived from an analysis of sensation. That is, it is derived from an analysis of the union. The only role that God plays in the Meditator's notion of extension is as the guarantor of its veracity. For the Meditator, the notion itself comes from the union. Consequently, just as with the notion of thought, we can say that the notion of extension is is not just *in principle* derivable from the union but is *in fact* derived from the union, within the order of the *Meditations*.

The result of this argument from the order of the *Meditations* is that both the notion of thought and the notion of extension turn out to have been derived from the union, via analysis. Put otherwise, for any human, the union, and the notion thereof, is necessarily prior to the notions of thought and extension. This is not to say, with Gassendi, that, despite his claims to the contrary, Descartes agrees that 'whatever is in the intellect must have previously existed in the senses' (Fifth Objections; AT ii: 186; AT vii: 267). Much, for Descartes, can be in the mind and not in the senses. But it is to say that, for

humans, the notions of thought and extension specifically must be derived from the union.

4.2.2.3 Argument from interaction

While discussing mind–body interaction with Elisabeth, Descartes tells he that he will explain the notions 'which belong to the union of the soul with the body, as distinct from those which belong to the body alone or to the soul alone' (CSMK: 218; AT iii: 666). To begin doing so, he makes use of an analogy with heaviness[17]:

> I think that we have hitherto confused the notion of the soul's power to act on the body with the power one body has to act on another. We have attributed both powers not to the soul, for we did not yet know it, but to the various qualities of bodies such as heaviness, heat, etc. We imagined these qualities to be real, that is to say to have an existence distinct from that of bodies, and so to be substances, although we called them qualities. In order to conceive them we sometimes used notions we have for the purpose of knowing bodies, and sometimes used notions we have for the purpose of knowing the soul, depending on whether we were attributing to them something material or something immaterial. For instance, when we suppose that heaviness is a real quality, of which all we know is that it has the power to move the body that possesses it towards the centre of the earth, we have no difficulty in conceiving how it moves this body or how it is joined to it. We never think that this motion is produced by a real contact between two surfaces, since we find, from our own inner experience, that we possess a notion that is ready-made for forming the conception in question. Yet I believe that we misuse this notion when we apply it to heaviness, which – as I hope to show in my *Physics* – is not anything really distinct from body. For I believe that it was given us for the purpose of conceiving the manner in which the soul moves the body
>
> (to Elisabeth, 21 May 1643; CSMK: 219; AT iii: 667–8).

Descartes's point is that the scholastic conception of real qualities as causal powers is only intelligible through the notion of the union (which, for Descartes, even scholastics would naturally possess, just because our nature's most vivid lesson is that we are each a union (see p. 92 above)). He claims that we immediately grasp what it means for heaviness to impel a body towards the centre of the earth, without questioning how the heaviness and the body interact, despite the body's being one kind of thing (a body) and heaviness's being another (a quality). We grasp it because we already have a notion

[17] He uses the same analogy for the same purpose in his correspondence with Arnauld (29 July 1648; AT v: 222–3) and, more restrictedly, in the letter to Clerselier in response to Gassendi's *Disquisitio Metaphysica sive Dubitationes et Instantiae* (AT ixA: 213) and in a letter to 'Hyperaspites' (August 1641; AT iii: 424). See, e.g., Garber (1983), which will be covered at length shortly, and Rozemond (1998: 119).

of just that kind of interaction available – a notion that Descartes claims was 'given us for the purpose of conceiving the manner in which the soul moves the body'. For Descartes, of course, heaviness is a misapplication of the notion, because there is no separate quality of heaviness to interact with the body in question. But, in order to get to this misapplication, you first need the notion of the union: without it, we would have no way to make sense of how the heaviness quality acts on the body. So our notion of the union is a prerequisite for the intelligibility of the scholastic conception of heaviness as quality–body interaction.

Garber (1983) uses the above passage from Descartes's letter to extend the same argument beyond quality–body interaction to body–body interaction.[18] In the letter that preceded the above, Elisabeth had asked for an account of mind–body interaction. This is how she sets out the question:

> I ask you please to tell me how the soul of a human being (it being only a thinking substance) can determine the bodily spirits, in order to bring about voluntary actions. For it seems that all determination of movement happens through the impulsion of the thing moved, by the manner in which it is pushed by that which moves it, or else by the particular qualities and shape of the surface of the latter. Physical contact is required for the first two conditions, extension for the third. You entirely exclude the one [extension] from the notion you have of the soul, and the other [physical contact] appears to me incompatible with an immaterial thing
>
> (Elisabeth to Descartes, 6 May 1643; Bohemia and Descartes 2007: 62; AT iii: 661).

Elisabeth assumes that body–body interaction is straightforwardly intelligible, and that the problem with mind–body interaction is that it cannot make use of the means by which body–body interaction is supposed to work (impulsion and shape). Garber's point is that there is no true body–body interaction in Descartes's system; instead,

> impact and the changes in bodily motion that result from impact are nothing but the changes that God must make in recreating the world from moment to moment in order to accommodate the motion of bodies to one another. Strictly speaking, bodies in motion are not real causes of change in impact, it would appear; motion

[18] Garber's position amounts to an endorsement of an occasionalist reading of Descartes, and a rejection of secondary causation in his system. This is by no means a settled matter in the scholarship. Hatfield (1979), e.g., also upholds the occasionalist reading, while Gabbey (1980), Gueroult (1980), Hattab (2000), and Schmaltz (2008) argue that Descartes does allow secondary causes, and Des Chene takes a nuanced, intermediate position (1996). In the present context, I am ultimately agnostic about the admissibility of secondary causes into Descartes's system: if the occasionalist position holds, then so does the my argument from interaction; if it doesn't, then neither does the argument from interaction (the arguments from containment and from the order of the *Meditations* are unaffected).

> transferred, motion begun, and motion ended in impact must derive from God himself, shuffling bodies about
>
> (Garber 1983: 26).

If that's the case, then all body–body interaction is really God–body interaction. God, of course, is not extended, so Elisabeth's argument against mind–body interaction applies equally to God–body interaction, which means, on Garber's reading, that it applies equally to body–body interaction (within Descartes's system). This, Garber takes it, is 'what Descartes should have told Elisabeth': rather than pointing out that the scholastic conception of heaviness could only be intelligible through the notion of the union, Descartes should have argued that the body–body interaction she takes to be so readily intelligible is itself only intelligible through the notion of the union. Indeed,

> [m]ind–body interaction must be basic and intelligible on its own terms since if it were not, then no other kind of causal explanation would be intelligible at all; to challenge the intelligibility of mind–body interaction is to challenge the entire enterprise of causal explanation. Furthermore, *we cannot give* a simpler or more easily understood account of causal interaction than mind–body interaction because *there are no more basic or more inherently intelligible ways of explaining the behavior of anything open to us*
>
> (Garber 1983: 29; emphases in original).

If body–body interaction collapses to God–body interaction, Descartes has no way to make sense of any causation in the physical world other than the notion of the union. In that case, far from being an aberration, mind–body interaction is the model for all physical causation.[19]

What this shows, if we accept Garber's reading, is that the priority of the notion of the union persists beyond the initial derivation of the notions of thought and extension: it is intrinsic to our understanding of body–body causation. This is because, for body–body interaction to only be intelligible on the model of mind–body interaction, we need to have already bought into the position that body–body interaction is really God–body interaction. So Garber's position applies once we have already taken on

[19] As Brown notes, '[i]f these arguments are correct, our understanding of the union is anything but a peripheral concern in Descartes' corpus' (2006: 140).

board the conclusions of the developed Cartesian system.[20] In the order of the *Meditations*, it would come in at the end, rather than the beginning. We have already established, in the previous two sections of this chapter, that the notions of thought and extension can only be derived from the union. And now it turns out that even once Descartes's dualism is established, there is at least one more thing (in addition to the union itself) that is inconceivable within his dualism. So, if all this is the case, Cartesian dualism cannot account for mind–body causation without importing the notion of the union – *and* it also cannot account for intelligible physical causation without importing the notion of the union.

In fact, there is an argument to be made that the point Garber makes can pushed considerably further, such that no physical causation at all is intelligible outside the model of the union. That argument would be a little too tenuous for me to rely on fully here, but it is worth noting its plausibility. Recall that, according to Descartes, our nature's most vivid lesson is that we are each a union, and that our minds and bodies interact within that union (CSM ii: 56; AT vii: 80). Above anything else – anything else at all – our nature teaches us mind–body interaction. Descartes repeatedly relies on this to show that mind–body interaction is intelligible in its own right, and is in need of no further explanation. He also relies on it to argue that scholastic quality–body causation appears intelligible only because we already have the model of mind–body causation. What is not clear is that Elisabeth's faith in body–body causation is all that different from the scholastic case – even without the extra step of recognising that body–body causation collapses into God–body causation.

We know that mind–body causation within the union is the first and most vivid notion we have. But Descartes does not tell us where we get the idea of body–body causation from. If body–body causation is really God–body causation, it seems unlikely that we get the idea from corporeal things themselves: since there is no causation between corporeal things, there cannot be anything in extension to give us our idea of physical causation. This does not require anyone to first *buy into* the body–body/God–body causation collapse for intelligibility to be a problem; it just requires that the collapse *is* the case, regardless of whether we realise. And so it seems that the only model we have for our intuitive conception of body–body causation is, again, mind–body causation within the union.

[20] In a later letter to Elisabeth, Descartes writes, 'I did not worry about the fact that the analogy with heaviness was lame because such qualities are not real, as people imagine them to be. This was because I thought that Your Highness was already completely convinced that the soul is a substance distinct from the body' (28 June 1643; CSMK: 228; AT iii: 694).

If this argument does hold, it means that physical causation is only ever intelligible through the notion of the union, regardless of whether or not we knowingly accept Descartes's dualism (or, regardless of where we are in the order of the *Meditations*). This would not be an incidental result: without physical causation, Descartes would not be able to account for any change in the physical world; he could have no physics, no mechanics, no physiology, no medicine, and so on. And, if Garber's argument is correct, physical causation is always unintelligible from within his dualism. It can only ever be conceived through a notion that is specific to the union.

4.2.3 Summary: the notion of the union is epistemically prior to the notions of thought and extension

For any human knower (i.e. a union), the notion of the union is a necessary epistemic prerequisite for the notions of thought and extension. The latter can only be derived from the former. The argument from containment above shows that there is an in-principle asymmetry of derivability between the notions: the notions of thought and extension can both be derived from the notion of the union, but not vice versa. The argument from the order of the *Meditations* then shows that the notions of thought and extension are in fact, and must be, derived from the notion of the union. Finally, the argument from interaction shows that this does not apply only to the initial derivation of the dualist notions, because a fundamental aspect of extension (body–body causation) is only conceivable through the union. All this means that the notion of the union has epistemic priority over the notions of thought and extension. In that sense, it is the 'most' primitive of our notions.

4.3 Different domains of conceivability

In the introduction to this chapter, I warned that Descartes's epistemology and metaphysics of the union would have to be teased out of the none-too-forthcoming comments he makes about the nature of the union. This section is where that teasing out begins in earnest. The result of the previous section – that the notion of the union is our most primitive – is problematic in the context of the familiar dualist system. In this section, I am going to propose that we can overcome those problems if we understand Descartes's dualist framework and his treatment of the union as belonging to two distinct domains of conceivability. The term 'domain of conceivability' is not Descartes's, of course, but the idea is derived from the conceptual isolation he describes between the conception of the union itself and the conception of the world

in terms of thought and extension. It is a reconstruction of the kind of epistemology that would allow him to reach the conclusions about the union that he does.

In the letter to Elisabeth quoted at the beginning of §4.2, Descartes lists multiple primitive notions. Chief amongst them are extension, thought and the union. He goes on to specify that these notions are specifically primitive in that each can be understood only through itself; a primitive notion cannot be understood through any other notion (AT iii: 665). And yet my claim throughout this chapter so far has been that the primitive notions of thought and extension both can be and, indeed, must be derived from the union. In some sense, then, they must be understood through the notion of the union. In light of Descartes's definition of primitive notions, it seems as though there is a serious problem in reconciling my reading here with Descartes's explicit statements about the notions of thought and extension. It might look as though I have to conclude that Descartes was either mistaken or misleading in labelling the notions of thought and extension as 'primitive'. That is not what I am going to conclude.

Instead, I take it that the notions of thought and extension are both primitive, as Descartes claims, *and* derived from the notion of the union. So all three notions are primitive, but the notion of the union is 'more' primitive. If being 'more primitive' sounds questionable, it should: another way of putting the problem here would be to ask how one thing can be more primitive than another. The argument in response goes as follows. We can reconcile the primitivity of all three notions with union-priority if the primitive notions of thought and extension, on the one hand, and the notion of the union, on the other, belong to two distinct domains of conceivability. This seems to be close to what Brown has in mind when she claims that '[w]hether we think of ourselves in terms of the minimal [mind only] or maximal [union] self depends on which explanatory [. . .] context we are in' (Brown 2014: 255). That is, the ontology changes depending on context: in the minimal context, the ontology includes mind but not union; in the maximal context, the ontology includes union.[21]

[21] *Cf.* Simmons (manuscript: 31–2): 'Since we do not have an intellectual idea of the union, but only a sensory one, the nature of union must stand outside the domain of Cartesian metaphysics. We have good evidence that it exists: the presence of sensations, appetites, and passions in tells us (that is, tells our intellects) that something more than aggregation is going on between our mind and body. But we cannot offer a positive metaphysics of it.' I am arguing here that the union does indeed stand outside the domain of dualist Cartesian metaphysics, but that that does not mean it has no metaphysical status available to humans: there is another domain of Cartesian metaphysics beyond his dualism.

Descartes equivocates between these two domains in his response to Elisabeth. In the first domain, the notion of the union is primitive, and the notions of thought and extension are not. In the second, the notions of thought and extension are primitive, and the union is inconceivable. Since the union is inconceivable in the second domain, the notion has to be imported from the first in order to fill in the conceivability gaps. The first domain has epistemic priority over the second inasmuch as it is our 'natural' domain of conceivability. The second is produced by abstraction from the first (but, once produced, becomes mostly independent).

This requires some unpacking. The second domain of conceivability is what we end up with after having been through the *Meditations*. It is what we standardly take Descartes's philosophy to consist in. Let's call it Domain_{D} for short. Domain_{D} is the preserve of the familiar Cartesian dualist system. Within it, the notions of thought and extension are primitive (along with the notions of being, number, duration, etc.). On this reading, the Cartesian project that we are familiar with from the *Meditations*, *Discourse on the Method*, *World*, and *Principles of Philosophy* is the project of establishing the conceivability of the world within Domain_{D}. If Descartes can show that the phenomena are explicable in the terms of Domain_{D}, then the project will have been successful. Crucially, Domain_{D} is only obtained with effort. It is not a given, for Descartes. As Brown puts it, 'we spend most of our time in the state of being a [union], and while it is possible for us cognitively to transcend that state to engage in pure thought or thought aided only by the imagination, it [. . .] is, in a way, unnatural' (Brown 2014: 249). We need to go through a process of establishing Domain_{D} (a process that Descartes variously refers to as 'philosophising', 'meditation', and 'metaphysics') – this is the entire point of the *Meditations*.

What is prior to the process of establishing Domain_{D} is our 'natural' domain of conceivability. This is how the Meditator conceives of things right at the beginning of the *Meditations*. For obvious reasons, let's call this domain of conceivability Domain_{U}. It is within Domain_{U} that we have the notion of the union that we have been over already – that is, the notion that our nature most vividly teaches us, or what Descartes calls 'the notion of the union which everyone invariably experiences in himself without philosophizing' (CSMK: 228; AT iii: 94). For all the reasons covered in the preceding sections of this chapter, this notion of the union is primitive in Domain_{U} (presumably along with the notions of being, number, duration, etc.).

What we do not have in Domain_U are primitive notions of thought and extension, although we do have non-primitive notions of them. This has to be the case because, as Descartes writes in the 28 June 1643 letter to Elisabeth,

> [i]t does not seem to me that the human mind is capable of forming a very distinct conception of both the distinction between the soul and the body and their union; for to do this it is necessary to conceive them as a single thing and at the same time to conceive them as two things; and this is absurd [*ce qui se contrarie*]
>
> (CSMK: 227; AT iii: 693).

Descartes's point here is that we cannot conceive of the union *and* of thought and extension as primitive notions simultaneously. The two positions are opposed.[22] The problems raised in §4.2.1 apply equally here. If you start with primitive notions of thought and extension (i.e. as really distinct, as in Domain_D), you cannot coherently unite them (by Descartes's definition of primitivity). By the same token, if you start with a primitive notion of a union of mind and body (as in Domain_U), you cannot also hold primitive notions of thought and extension, just because those notions would have to be conceptually isolated from the notion of the union in order to *be* primitive. Put another way, the notions of thought and extension necessarily would not be able to tell us anything about the notion of the union, because, if they could, they would not be primitive. But, if they could not tell us anything about the notion of the union, they would necessarily have to be notions of something other than thought and extension (because the union is a union of thought and extension). Consequently, the notions of thought and extension that we have within Domain_U (i.e. the notions of the two parts of the union) cannot be primitive notions.

So, within Domain_U, we cannot conceive of thought and extension as primitive notions, although we can easily conceive of them as two sides of the union (i.e. as non-primitive notions). As soon as we start thinking of thought and extension as primitive notions (that is, as really distinct), we can no longer maintain our natural conception of the union. In the terms I am using here, then, this necessarily constitutes a switch from Domain_U to Domain_D. This is what I take Descartes's proscription against conceiving both the union and the thought/extension distinction at the same time to consist in. We cannot conceive both of the union and of primitive notions of thought and extension simultaneously just because we need to change domains of conceivability: on

[22] See Yandell 1997 on logical and conceptual contradiction in Descartes's treatment of the union. See also (Brown 2014: 245).

this reading, Descartes's temporal restriction gets cashed out in domain switching.[23]

Both thought and extension are conceivable within Domain_U. The same cannot be said of the union within Domain_D.The union cannot be accounted for in the terms of Domain_D. For all the reasons established in §4.2, the union is entirely inconceivable within Domain_D: this is an epistemic gap in that domain of conceivability. In order to account for the union (and in order to account for, at least, body–body causation as well), Descartes has no choice but to import the primitive notion of the union wholesale from outside Domain_D. This is why the idea of mind–body causation appears so incoherent with our picture of Descartes's philosophy, and why Elisabeth, Gassendi, and so many others since see it as a failure within his system: we take it that Descartes has nothing but Domain_D, and so we assume that the union must be conceivable within Domain_D, when it is instead taken from a different domain of conceivability altogether. This is also why the union is usually addressed as a problem of mind–body causation – because mind and body are the only seemingly relevant terms available within Domain_D. But the Domain_D-notions of mind and body (or thought and extension) have nothing to do with the notion of the union from Domain_U (if they did, of course, the notion of the union would no longer be primitive). The notion of the union is an alien within Domain_D; importing it from Domain_U is Descartes's only available option for patching the epistemic gaps (i.e. at least the union itself and, if Garber is right, body–body causation) within Domain_D.

It is no surprise that we have tended to assume that what I am calling Domain_D is all there is to Descartes's philosophy. Descartes himself recognises as much. In his 21 May 1643 letter, he writes the following to Elisabeth:

> I may truly say that the question [i.e. the question of mind–body causation[24]] which Your Highness poses seems to me the one which can most properly be put to me in view of my published writings. There are two facts [*choses*] about the human soul on which depend all the knowledge we can have of its nature. The first is that it thinks, the second is that, being united to the body, it can act and be acted upon along with it. About the second I have said hardly anything; I have tried only to make the first well understood. For my principal aim was to prove the distinction between the soul

[23] This parallels the 'shift in thinking about the self' that Brown identifies in Descartes's treatment of the union: '[t]he product of reflecting on my experiences of embodiment is a different sense of self from the one Descartes relies on in the real distinction argument' (Brown 2014: 244).

[24] See Elisabeth to Descartes, 6 May 1643 (AT iii: 660–2; Bohemia and Descartes 2007: 61–2) and §4.2.2.3 above.

> and the body, and to this end only the first was useful, and the second might have been harmful
>
> (to Elisabeth, 21 May 1643; CSMK: 217–8; AT iii: 664–5).

Descartes notes here that his published work (which, at that point, included both the *Meditations* and the *Discourse*) had focused almost exclusively on the soul as a thinking thing. Given that he takes the conceivability that pertains to the union ($Domain_U$) to be naturally, unavoidably available to us all, while getting to the conceivability of the dualist system ($Domain_D$) requires work, his focus on the latter makes sense. He needed both to establish $Domain_D$ in the first place and then to show that the phenomena of the world are conceivable within $Domain_D$. By contrast, there is little need to say much about the union if we get our notion of it so naturally. He brings all this up in the letter to Elisabeth in order to make clear why she sees mind–body causation as a problem for his system while he does not. His point is that it is his prior focus on the soul as a thinking thing that has erroneously given her the impression that everything must be conceivable in the terms of $Domain_D$. That focus, he admits here, was pragmatic: it was needed in order to get an unwilling audience to start thinking within a system that was new to them. Since, as we have seen, the notions of the dualist system are useless for explaining the union, what Descartes had so far left unsaid about the union could only be expressed in the notions that pertain to the union itself. In other words, if Descartes wants to talk about the union, he has to do so in the terms of $Domain_U$. Because of its epistemic gaps, $Domain_D$ is incapable of fully superseding $Domain_U$.

It is immediately after the passage quoted above that Descartes introduces the primitive notions of union, thought, and extension, and their conceptual isolation. We are now in a better position to provide a reading of his claim that 'we go wrong if we try to explain one of these notions by another, for since they are primitive notions, each of them can be understood only through itself' (to Elisabeth, 21 May 1643; CSMK: 218; AT iii: 666), when it is evident that both thought and extension not only can be but actually are derived from the notion of the union. It is by virtue of belonging to different domains of conceivability that the notion of the union and the notions of thought and extension are conceptually isolated. The union is inconceivable within $Domain_D$, so, while the notion can be used to patch over epistemic gaps, it cannot tell us about anything in the terms of $Domain_D$. And since the $Domain_D$-notions of thought and extension are notions of independent, incompatible substances, they cannot tell us about anything in the terms of $Domain_U$, where thought and extension are fundamentally the two parts of a union that has priority over them.

This reading makes sense of how the notions of the union, thought, and extension can still be properly primitive. And it is because of the epistemic priority of Domain_{U} over Domain_{D} that the notion of the union gets be 'more' primitive. As we have seen, Domain_{U} is a natural given for all humans, while it takes work to produce Domain_{D}. We always have to get to Domain_{D} *from* Domain_{U} just because Domain_{U} is our natural domain of conceivability. As established in §4.2.2.2, the notions that belong to Domain_{D} are derived by analysis of certain notions within Domain_{U}. That makes Domain_{D} an abstraction from Domain_{U}, in that it is a new domain of conceivability built on notions removed from their original context within Domain_{U}.[25] All this means that Domain_{U} necessarily has epistemic priority over Domain_{D}. And this is what it means for the notion of the union to be more primitive than the notions of thought and extension: the notion of the union is conceptually isolated from the Domain_{D}-notions, and it will also always have epistemic priority over them, exactly because Domain_{U} has epistemic priority over Domain_{D}.

4.4 The ontological priority of the union

So far, this chapter established that the notion of the union has epistemic priority over the notions of thought and extension. We still need to look at the metaphysics implied by Descartes's treatment of the union to see how that epistemic priority translates into ontological priority for the union itself. What characterises the switch from Domain_{U} to Domain_{D} is that within Domain_{D} we adopt an objective view of the world: Domain_{D} is an attempt to conceive the world as what Williams calls 'the absolute conception of reality' (1978: 65), or what Nagel (1989) calls the 'view from nowhere'. The notions of thought and extension we have within Domain_{D} are notions of thinking and extended substances respectively that exist independently (or quasi-independently, subtended by God, who is the only truly independent substance (*Principles* 1/51; AT viiiA: 24): thinking substance and extended substance are what they are regardless of any human conception. On the face of it, that might seem to give thinking and extended substances ontological priority over the union. If we assume (like Elisabeth, etc.) that Domain_{D} is all Descartes has, then the union is going to look like some kind of vague, magical aggregate of mind and body (because the union is inconceivable within Domain_{D}). That is, it is going to look as though the union is dependent on its

[25] *Cf.* the discussion of intellectual abstraction in the letter to Gibieuf of 19 January 1642: '[t]his intellectual abstraction consists in my turning my thought away from one part of the contents of this richer idea the better to apply it to the other part with greater attention. Thus, when I consider a shape without thinking of the substance or the extension whose shape it is, I make a mental abstraction. I can easily recognize this abstraction afterwards when I look to see whether I have derived this idea of the shape on its own from some other, richer idea which I also have within myself' (CSMK: 202; AT iii: 475). See also Nolan 1997: 133.

ontologically well-grounded components, thereby making it ontologically posterior to them.[26]

But, on the reading given in this chapter, Domain_D is not all that Descartes has. And the situation looks rather different from within Domain_U. Whenever Descartes discusses the conceivability that pertains to the union, it is clear that he is talking about a subjective standpoint rather than an objective view.[27] What our nature most vividly teaches us is that 'I have a body, and that when I feel pain there is something wrong with the body, and that when I am hungry or thirsty the body needs food and drink, and so on' (CSM ii: 56; AT vii: 80). We understand the world, within Domain_U, 'by the surest and plainest everyday experience' (for Arnauld, 29 July 1648; CSMK: 358; AT v: 222). And what characterises Domain_U is sensation. Sensations, Descartes tells us in the *Principles*, 'must not be referred either to the mind alone or to the body alone. These arise [. . .] from the close and intimate union of our mind with the body' (1/48; CSM i: 209; AT viiiA: 23). That I have a body, the pain I feel that tells me there is something wrong with that body, hunger, thirst, and so on – these are all sensations (internal sensations, as Descartes sometimes specifies (CSM i: 316–8; see Simmons 2011: 64)).

For Descartes, sensation is always concerned with benefit and harm to the union (AT vii: 83). And, he writes in the *Meditations*, 'in matters regarding the well-being of the body, all my senses report the truth much more frequently than not' (CSM ii: 61; AT vii: 80). So, sensation reports truths, and the truths it reports are indexed to a particular union. That sounds like a good description of a subjective standpoint.[28] The question, then, is what exists from this standpoint[29] – what is the ontology of Domain_U? At the

[26] Although that, of course, would make the union 'absolutely' an *ens per accidens*, which is a position Descartes rejects (AT iii: 461; AT iii: 493; AT iii: 508).

[27] This 'objective view' is distinct from Cartesian/scholastic objective reality. The latter refers to the intrinsic reality of a thing, or (when contrasted with formal reality) to the represented side of a representational relation (AT vii: 40). The former is a framework in which ontological statuses are assigned; it is objective in that the ontology disregards perspective.

[28] Simmons calls this subjectivity '*narcissistic* representation', or a 'representation of the world *as mattering to me*' (2014: 269; emphasis in original).

[29] If we are accustomed to thinking of ontology purely in terms of an objective view, then the notion of existence from a subjective standpoint might sound strange. Chapter Six will show that, and how, the

very least, the union must exist. The union is, after all, the standpoint itself. Consequently, it seems that not only must the union exist, but it also must have ontological priority over whatever else there may be in Domain_U. To see why this is so, it is useful to look at what ontological priority is for Descartes.

In his relatively recent paper on ontological priority monism, Schaffer contends with scepticism about ontological priority. He writes, '[t]he assumption that there are priority relations between actual concrete objects is weighty and controversial [. . .]. [. . .] [I]t is controversial to allow that there is such a thing as priority at all' (2010: 36). We do not have that problem here: Descartes fully endorses ontological priority and posteriority, in terms of more or less reality. This difference in degree of reality (which we covered in terms of containment in §4.2.2.1) cashes out in degrees of dependency: the less on which a thing depends, the more reality it has (AT vii: 185), and the more reality, the greater the ontological priority. Within the standpoint of Domain_U, the union is the fundamental given. It depends on nothing but itself (within Domain_U).[30]

This is surprising: for the union to be something with no further dependencies is (literally) blasphemy on the standard interpretation of Descartes. He is explicit that only God is truly independent; everything else has at least one further dependency ('we perceive that they can exist only with the help of God's concurrence' (*Principles* 1/51; CSM i: 210; AT viiiA: 24)). But that is only the case within Domain_D, where we take the view of an absolute conception of reality. On that conception, it it is certainly conceivable that I might depend on something beyond myself. But within the metaphysics of a subjective standpoint, it is nonsensical for the standpoint itself to depend on something beyond itself. That is, as soon as we start talking about the dependency of the union on something else, we have already jumped out of Domain_U and into some other domain of conceivability (in this case, Domain_D).

So, the union depends on itself alone (within Domain_U). And since everything within Domain_U is indexed to the union, everything within Domain_U, besides the union itself,

existence in question is non-independent existence. In the case of the union that pertains to me, its existence is non-independent in that it is inextricable from me. This is not as obscure as it sounds: I *am* the union that pertains to me (or an intrinsic part of it, if I am just a mind), so of course I am inextricable from it. See Chapter Six, §6.2.4.

[30] Descartes calls his principle of ontological priority 'completely self-evident' (CSM ii: 130; AT viiiA: 24), and since he takes its self-evidence to be prior to, and not reliant upon, the abstractions in the switch to Domain_D, it seems safe to assume that the principle applies within Domain_U.

has a further dependency (i.e. the union to which it is indexed). This means that the union has more reality than anything else within Domain_U, which means that it has ontological priority over everything else within Domain_U. So, the union has ontological priority over the mind and body that compose it[31] – so, within the metaphysics implied by Domain_U, the union has ontological priority over thought and extension.

4.5 Union-priority metaphysics and the problem of mind–body interaction

Having established that, within Domain_U, the notion of the union has epistemic priority over the notions of thought and extension, and that the union itself has ontological priority over thought and extension themselves, we are in a good position to see how Descartes's union-priority metaphysics dissolves the problem of mind–body causation. I have noted a couple of times already (85, 103) that the union gets treated as a problem specifically of mind–body causation – indeed, as a problem at all – only because we expect Descartes to account for it in the terms of a domain of conceivability in which it is inconceivable. All that is available within the dualism of Domain_D are mind and body, so the union appears to be an intractable problem of making two necessarily incompatible substances compatible. Within Domain_U, however, that problem never arises.

As established above, within Domain_U, mind and body are not incompatible, independent substances with a real distinction between them; if they were, the union would still be inconceivable. Instead, they are the two sides of the union that has ontological priority over them both. Within Domain_U, mind and body are what Schaffer calls 'dependent fragments of an integrated whole' (2010: 33).[32] Consequently, what appears as interaction between incompatibles in Domain_D is really only intra-action[33] within the integrated whole that is the union.[34] As such, there is no

[31] Another way to look at this is through Schaffer's argument that integrated wholes (as opposed to aggregates) intuitively have priority over their parts (Schaffer 2010: 47–8). Within Domain_D, that would not hold, because analysis overrides intuition. But within Domain_U, intuition (in the form of sensation) overrides analysis.

[32] Or 'parts as arbitrary abstractions' (Schaffer 2010: 46). Cf. Descartes's discussion of a 'unity in its own right' (CSM ii: 156–7; AT vii: 222–3), and (Brown 2014: 244).

[33] I take the term from Barad (2007: 33). Barad's agential realism is developed in a very different context (quantum mechanics), but it has parallels with the subjective metaphysics proposed here.

compatibility problem between mind and body within Domain_U, exactly because their distinction (within Domain_U) is only abstracted from their fundamental union. This captures Descartes's repeated insistence that there is no problem of the union, that mind–body interaction is something we grasp naturally and immediately, and that there is no need for further explanation in terms of incompatible substances. The union is simply something that cannot be addressed within Domain_D, but it is the easiest thing in the world to account for within Domain_U. Metaphysically, for Descartes, the union has to be an integrated whole, because that is what it is within Domain_U, and it cannot be accounted for at all within Domain_D. As such, mind and body are only secondary, dependent abstractions (in the metaphysics implied by Domain_U), and not independent, incompatible substances. Consequently, there is no problem of mind–body interaction.

4.6 The union and nonreductionism

If my reading here is correct, it has at least two significant implications for Descartes's reductionism. First, and simplest, the union has to be understood as an integrated whole prior to its parts. It is not, fundamentally, a combination of two more ontologically basic units (i.e. mind and body). Instead, mind and body are derivable abstractions from the union. They are abstractions that can be used to build up classical Cartesian dualism, where they are hypostatised as independent substances, to be sure. But classical Cartesian dualism has no means of addressing the union, so, when we are addressing the union, its ontological status within Domain_U has to be what counts. And, within Domain_U, to reduce the union to mind and body is to be in error about the ontological priorities: it is to mistake less reality for more. What is ultimately evident is that reduction of the union to mind and body makes the union demonstrably, infamously less intelligible (to the point of inconceivability). And this is why Descartes has to account for it nonreductively.

Second, Descartes still requires the union in his dualist metaphysics in at least a couple of ways: to explain humans, and to explain how body–body causation can be intelligible to humans. But, because classical Cartesian dualism cannot address the union, there is nothing in the dualist ontology for the union to be reduced to. Consequently, he has to

[34] Hence, I agree with Simmons that 'we cannot use the primitive notion of union to develop a metaphysics of mind-body causation' (), but for different reasons. Simmons takes it that all Cartesian metaphysics requires the intellect, and that we have no intellectual notion of the union. I take it that what looks like mind–body causation from the perspective of the dualist metaphysics is instead intra-action from the perspective of the subjective metaphysics that pertains to the union.

import the notion, along with its nonreductionist metaphysical baggage, from Domain_U. That is, Descartes's dualism produces epistemic and ontological gaps that he patches only by invoking a separate nonreductionist (and non-dualist) epistemology, which implies a separate nonreductionist, non-dualist metaphysics. He uses nonreductionism to cover up for the shortfalls in his reductionist project. That is quite a win for nonreductionism.

4.7 Conclusion

This chapter has argued, first, that, for humans, the notion of the union has to be epistemically prior to the notions of thought and extension for Descartes. It has to be our 'most primitive' notion. It has also argued that the metaphysics implied by Descartes's treatment of the union gives the the union ontological priority over mind and body, or thought and extension, themselves – at least, it has ontological priority within Descartes's only metaphysical means of accounting for the union. This dissolves the problem of mind–body interaction by showing that, when understood within the metaphysical context proper to the union, there never was a problem of mind–body interaction. It also shows that Descartes, that archetypal reductionist, has no choice but to rely on nonreductionism to address what his reductionist project cannot.

Chapter 5

Knowledge acquisition and natural philosophy

5.1 Introduction

Even if Descartes does allow an irreducible (the union) into his philosophy, it is not at all clear how we can possibly come to acquire legitimate knowledge of it. This is because the epistemological project that he sets out in the *Meditations* seems to require reducibility as a necessary condition of knowledge (because the intellect needs to reduce confused ideas down to their simple constituents in order to make existential and essential judgements – see §5.4.1); this appears to rule out any knowledge of irreducibles. In the following, however, I argue that the epistemic aims and methodology of the *Meditations* do not extend to Descartes's natural philosophy.

The argument is based on an analysis of the rule of knowledge acquisition that Descartes asserts in correspondence with Elisabeth, to Burman, and, according to Clerselier, frequently in conversation. The rule states that, in order to acquire knowledge, we should devote the vast majority of our study time to activity that integrates sensation, imagination, and intellect, and should spend almost no time at all on activity that engages the intellect alone. This rule seems to be entirely antithetical to the canonical epistemological project of the *Meditations*: it seems to privilege the epistemic worth of the senses and imagination over that of reason, at least in terms of time allocation. In the following, I argue that the project of the *Meditations* has only a

very limited scope[1]: it is restricted to knowledge acquisition in first philosophy; Descartes's requirements for knowledge in natural philosophy are somewhat different, relying largely on knowledge acquired through sensation.

The latter result is nothing new. Even if the textbook version of Descartes portrays him as requiring all knowledge to proceed deductively from clear and distinct grounds, the literature has diligently reiterated that that is simply not the case. Clarke goes so far as to claim that we should privilege Descartes's more empirical, scientific works over his canonical philosophy texts (Clarke 1982: 2).[2] He then provides a good overview of established positions on Descartes's scientific method, with a view to just how a priori or a posteriori it is (1982: 9–10). That summary is fairly old by now, though, and a lot of work has been done subsequently on the role of knowledge acquired through observation and experiment in Descartes's science – e.g. Hatfield (1985), Wilson (1995), Gaukroger (1995b; 2002), the entire second part of Gaukroger, Schuster and Sutton 2000, Garber 2001c, Buchwald 2008, and Schuster 2012. This chapter does not stray far from what has already been established with respect to the more 'empirical' side of Descartes's natural philosophy. Where it differs is in its focus on the place of reductionism in all of this; here, I establish what role reductionism plays in Descartes's natural-philosophical knowledge acquisition in order to show, in the next chapter, what kind of nonreductionist knowledge is possible for Descartes.

The chapter is structured as follows. Descartes's knowledge acquisition rule is introduced in §5.2.1. In §5.2.2, I argue that the rule is based on epistemic productivity: Descartes takes the integrated activity to be more fruitful than the activity of the intellect alone (§5.2.2.1). This is not because purely intellectual activity is entirely fruitless, but because the knowledge it can acquire is limited (§5.2.2.2): beyond what Descartes has already established in the *Meditations*, there is little left for the pure intellect to do. Then §5.3 sets out exactly what the integrated activity propounded in Descartes's rule does and does not involve: it does not involve first philosophy, which is the preserve of the pure intellect (§5.3.1); it does involve observation and experiment (§5.3.2). Finally, I assess the consequences of all this for Cartesian reductionism and nonreductionism (§5.4). In §5.4.1, I argue that the role reductionism plays in Cartesian knowledge acquisition is to validate the independent existence of external things (with their particular essences). I then conclude, in §5.4.2, by showing that Descartes can

[1] *Cf.* Simmons: '[. . .] the place of metaphysics itself in Cartesianism, which, I suggest, has been overplayed in our canonical narrative' (manuscript: 5).

[2] See p. 129 below.

allow for nonreductionist knowledge (just how that nonreductionist knowledge works will be the subject of the next chapter).

5.2 Integration of intellect, imagination, and sensation

5.2.1 Descartes's rule of knowledge acquisition

On several occasions, Descartes explicitly advocates leaving behind the approach of the *Meditations* – that is, the approach with which the historiography of philosophy has come to identify his philosophy almost entirely – in order to concentrate on the use of the imagination and/or the experience of the senses (more or less broadly construed). In the 28 June 1643 letter to Elisabeth, Descartes writes,

> I am almost afraid that Your Highness may think that I am not now speaking seriously; but that would go against the respect which I owe her and which I will never cease to show her. I can say with truth that *the chief rule I have always observed in my studies, which I think has been the most useful to me in acquiring what knowledge I have, has been never to spend more than a few hours a day in the thoughts which occupy the imagination and a few hours a year on those which occupy the intellect alone.* I have given all the rest of my time to the relaxation of the senses and the repose of the mind
>
> (to Elisabeth, 28 June 1643; CSMK: 227; AT iii: 692–3; my emphasis).

Descartes professes fear that Elisabeth will question his seriousness because what he is about to say appears to deviate sharply from the philosophical methodology for which he was, and is, best known.[3] This much is clear from the context of the letter, in which Descartes is attempting to assuage Elisabeth's concerns about mind–body interaction; he is just about argue that the union is only confusing when you try to understand it in the terms of the *Meditations*, rather than in its own terms (see Ch. 4, §4.2.1). What he expects Elisabeth to find surprising is his claim that he has only ever spent a few hours a day on matters that occupy the imagination, and only a few hours *a year* on matters that are purely of the intellect. This is not merely a matter of his personal preferences in the way he spends his time: his claim is that this particular distribution of his time is what has been 'most useful' to him 'in acquiring knowledge'. That is, the rule of knowledge acquisition he specifies here recommends largely avoiding activity that occupies the intellect alone.

[3] To an extent, the passage parallels a remark makes at the beginning of the *Meditations*, where Descartes claims that 'it was necessary, once in the course of my life, to demolish everything completely and start again' (CSM ii: 12; AT vii: 17). The difference is that, in the *Meditations*, Descartes is asserting the need for this project, while, in the letter, he stresses the need to discard the methodology of the *Meditations* for all but a few hours each year.

This purely intellectual activity is metaphysical thought of the kind involved in the project of the *Meditations*, as he specifies a few sentences earlier in the letter.[4] Despite its being precisely this kind of thought with which Elisabeth associates his philosophy, Descartes suggests, he claims to have spent very, very little time on it indeed. His biographer, Baillet, seems to have been just as surprised about this as Descartes expected Elisabeth to be: Baillet calls it 'a paradox' (AT x: 202). Descartes's self-assessment in these terms appears to be a consistent theme, at least according to Chanut, who reported that Descartes would frequently repeat the rule (AT x: 202–3).[5] The implication of this, and the reason for both Elisabeth's potential surprise and Baillet's paradox, appears to be that the *Meditations* project is not nearly as central to Descartes's work as Elisabeth and Baillet take it to be.

Descartes glosses those thoughts that occupy the imagination and take up a few hours a day as both 'all serious conversations and anything which needs to be done with attention' and simply 'study' (CSMK: 227; AT iii: 693). The implication in this case is that the vast majority of his work is done through the imagination, and not through the pure intellect. He could be clearer about what it is that he does with the rest of his time, but it seems that by 'the relaxation [*relasche* (i.e. *relâche*)] of the senses and the repose of the mind' here, what he means is 'the ordinary course of life' (CSMK: 227; AT iii: 692), given that, in the same letter, he identifies 'the ordinary course of life and conversation' with 'abstention from meditation and from the study of the things that exercise the imagination' (CSMK: 227; AT iii: 693). Most of the time, he eats and drinks and walks his dog and lazes around until late morning.[6]

It is notable that Descartes claims that dedicating the least part of his time to activity of the pure intellect is the rule that 'has been the most useful to me in acquiring what knowledge [*connoissance* (i.e. *connaissance*)] I have' (to Elisabeth, 28 June 1643; CSMK: 227; AT iii: 692–3). It is notable that Descartes takes forsaking pure-intellect-activity to be the route to knowledge (or part of that route), because the traditional view of Descartes's epistemology is that pure-intellect-activity is the *only* worthwhile route to knowledge. As this textbook account puts it,

[4] 'Metaphysical thoughts, which exercise the pure intellect, help to familiarize us with the notion of the soul' (to Elisabeth, 28 June 1643; CSMK: 227; AT iii: 692–3).

[5] Chanut's remark is reported by Baillet via Clerselier; given the degrees of separation, the reliability of the statement might be arguable.

[6] On Descartes's everyday habits, see (Gaukroger 1995: 384).

> Descartes, along with many other seventeenth- and eighteenth-century philosophers, took it that any knowledge worthy of the name would be based on cognitions the truth of which is guaranteed (infallible), that were maximally stable, immune from ever being shown to be mistaken (incorrigible), and concerning which no reasonable doubt could be raised (indubitable). Hence the search in the *Meditations* for a divine guarantee of our faculty of rational intuition
>
> (Alston 1992: 384).

Or as Descartes himself unequivocally puts it in the *Rules*, '[a]ll knowledge is certain and evident *cognition*' (Rule 2; CSM i: 10; AT x: 362; my emphasis). If cognition or rational intuition are what Descartes needs for the acquisition of knowledge 'worthy of the name', we should expect his rule of knowledge acquisition to be the opposite of what he tells Elisabeth and others: we should expect that he privilege study time spent on pure-intellect-activity over that spent on anything else. And yet, he tells us that what he does, and should do, is the exact opposite. That is not to say that Descartes's knowledge acquisition rule is necessarily incompatible with some form of epistemic foundationalism; but the rule does suggest that his wider means of knowledge acquisition should not be confused with his means for establishing epistemic foundations. And the rule does seem puzzling in the context of a purely rationalist reading of Descartes's philosophy – hence, again, Baillet's paradox, and Descartes's expectation of Elisabeth's surprise.

5.2.2 Productivity in the acquisition of knowledge

There are at least three ways to read Descartes's knowledge acquisition rule. Pure-intellect-activity is afforded the least amount of time because either (a) pure-intellect-activity is more taxing than imagination-activity in one way or another and so cannot be maintained for as long; or (b) pure-intellect-activity is overall less fruitful, in some significant way, than imagination-activity, and so deserves less time; or (c) imagination-activity is more time-consuming than pure-intellect-activity, and so requires more time. I am going to argue that reading (b) holds, that reading (c) is both compatible with (b) and plausible, and that reading (a) is unlikely. Here are the reasons for (a) and (b); (c) will wait until §5.3.

5.2.2.1 Pure-intellect-activity and epistemic unproductivity

In a recent paper on Mediation Six, Brown discusses the knowledge acquisition rule and appears to interpret it in terms of (a):

> [i]n these passages [i.e. those concerning the knowledge acquisition rule], the implication is that the self which is identified with the pure intellect is not one we can inhabit for very long; that it takes a supreme mental effort *not* to think using the senses; and that it takes a substantial though diminished effort by comparison to think using the imagination
>
> (2014: 246).

Brown takes the limited allocation of time to pure-intellect-activity to be due to the sheer difficulty of maintaining its cognitive purity. While I am more than sympathetic to the wider point Brown is making here, the evidence is not in favour of this particular reading: from what Descartes tells us, pure-intellect-activity simply is not all that difficult. He never claims that intellect-activity of this kind is especially taxing to maintain. And, as he puts it in Meditation Six, we 'notice quite clearly that imagination requires a peculiar effort of mind which is not required for understanding' (CSM ii: 51; AT vii: 72–3). And experience seems to bear this out: intellectually conceiving of, say, a chiliagon seems no more difficult than imagining a triangle. Indeed, it is arguably considerably easier to conceive of a chiliagon intellectually than it is to imagine shapes even only a little more complex than a triangle. A decagon, for instance, takes some imaginative work, while simply conceiving of a thousand-sided shape is effortless. Descartes points out that imagining even a pentagon requires some exertion (AT vii: 72–3). This suggests that thinking using the pure intellect does not necessarily take extraordinary mental effort – certainly no more so than the use of the imagination does. So (a) seems an unlikely reading: it is not that Descartes has spent such little time on pure-intellect-activity because it is more difficult than the other options.

What presumably *is* supremely difficult (to the point of impossibility), however, is to think without the senses and still get anything much done in the world: conceiving of a polyhedron in the abstract is highly specialised, and, by itself, of extremely limited application; even writing about chiliagons is going to require employing the senses (at the very least, because writing is visual[7]). This brings us back to (b): perhaps pure-intellect-activity is simply less fruitful than imagination-activity. Descartes has more to say about the relative productivity of pure-intellect-activity and imagination-activity when he repeats his interdiction against meditation a few paragraphs further on in the same letter. This time, the message is both clearer and stronger:

> I believe that it is very necessary to have properly understood, once in a lifetime, the principles of metaphysics, since they are what gives us the knowledge of God

[7] Or tactile, in the case of Braille, of course – either way, writing requires sensation.

> and of our soul.[8] *But I think also that it would be very harmful to occupy one's intellect frequently in meditating upon them, since this would impede it from devoting itself to the functions of the imagination and the senses.* I think the best thing is to content oneself with keeping in one's memory and one's belief the conclusions which one has once drawn from them, and then employ the rest of one's study time to thoughts in which the intellect co-operates with the imagination and the senses
>
> (to Elisabeth, 28 June 1643; CSMK: 228; AT iii: 695; my emphasis).

Whereas in the earlier passage Descartes merely relegated the type of activity that pertains to the *Meditations* project to the periphery of his wider knowledge-gathering, by dedicating the least amount of time to it, here he goes further, and explicitly paints it as 'very harmful'to the enterprise (when done frequently). Doing too much metaphysics, Descartes tells Elisabeth, actively impedes one's study; it gets in the way of what you need to do to in order to acquire knowledge.[9] If we want knowledge, Descartes claims, we need to avoid pure-intellect-activity involved in doing metaphysics. So, after a certain point, pure-intellect-activity is a diversion – at least a partial diversion – from the main work of acquiring knowledge. So it does seem that Descartes takes pure-intellect-activity to be less fruitful, in some way, than activity 'in which the intellect co-operates with the imagination and the senses'.

If what Descartes calls the 'relaxation of the imagination and repose of the intellect' CSMK: 227; AT iii: 692–3) is indeed the course of ordinary life (see p. 114 above), then the intellect-imagination-sensation-activity (hereafter, 'IIS-activity') that Descartes refers to in the passage above must be the same as the imagination-activity that he brings up in the earlier passage, presumably just better specified. So, the imagination-activity of the original passage is, more properly, IIS-activity. This is because, in the context of Descartes's knowledge-acquisition rule, there is nothing else for this activity to be. IIS-activity is clearly not pure-intellect-activity, both because it involves imagination and sensation in addition to the intellect (and so is not purely of the intellect), and because Descartes is explicitly opposing it to pure-intellect-activity here. And it is presumably not the relaxation of the imagination and repose of the intellect, because it involves the imagination. So we can say that Descartes takes pure-intellect-

[8] This again echoes the beginning of the *Meditations*. But what was presented in the *Meditations* as nothing other than an epistemically productive activity goes on to be treated here as an epistemic hinderance.

[9] Simmons (2014: 268) reads Descartes's warning about the overuse of pure-intellect-activity in this passage in relation to its negative effect on the ordinary course of human life – the function of the senses is to preserve the union, and if we abandon them for the sake of the pure intellect, we will stop taking care of ourselves. This is certainly true as well.

activity to be less fruitful, in some significant way, than imagination-activity/IIS-activity, and therefore that (b) is a viable reading.

5.2.2.2 Pure-intellect-activity and diminishing returns

We know there is a difference in fruitfulness between pure-intellect-activity and IIS-activity, then, but there are various forms this difference could take. It might be all-inclusive – it might be that IIS-activity is simply better than pure-intellect activity in every way. But that does not seem likely, given everything that Descartes says in favour of pure-intellect-activity elsewhere. He certainly takes there to be epistemic value in pure-intellect-activity, and views of the kind typified by Alston (quoted above, p. 114) do not come out of nowhere. In the 28 June 1643 letter, Descartes affirms the importance of going through a process of meditation, although this is qualified as something that should be done 'once in a lifetime' and, it is implied, preferably not again. Not coincidentally, this is also exactly how the project is introduced at the beginning of the *Meditations*: it is 'necessary', but only 'once in the course of my life' (AT vi: 17). So Descartes clearly does take pure-intellect-activity to be valuable, albeit for a limited period; the difference in fruitfulness between IIS-activity and pure-intellect-activity is clearly not all-encompassing, but must be due to diminishing returns with the latter.

What pure-intellect-activity does give us, according to the letter to Elisabeth, is knowledge of God and our soul (AT iii: 695). Although Descartes does not say as much here, presumably pure-intellect-activity also gives us knowledge of (at least) the fundamental nature of substance (AT vii: 31) and the reality of the external world (AT vii: 80). That is valuable knowledge worth acquiring, but – and this is the point that Descartes is making to Elisabeth (as well as more widely in conversation, if Chanut, Clerselier, and Baillet are to be believed) – it pales in comparison to the breadth of knowledge that can be acquired through IIS-activity. Descartes brings all this out reasonably explicitly in the *Conversation with Burman*:

> A point to note is that one should not devote so much effort to the *Meditations* and to metaphysical questions, or give them elaborate treatment in commentaries and the like. Still less should one do what some try to do, and dig more deeply into these questions than the author did; he has dealt with them quite deeply enough. It is sufficient to have grasped them once in a general way, and then to remember the conclusion. *Otherwise, they draw the mind too far away from physical and observable things, and make it unfit to study them. Yet it is just these physical studies that it is most desirable for people to pursue, since they would yield abundant benefits for life.* The author did follow up metaphysical questions fairly thoroughly in the *Meditations*, and established their

> certainty against the sceptics, and so on; so everyone does not have to tackle the job for himself, or need to spend time and trouble meditating on these things
>
> (Conversation with Burman; CSMK: 346–7; AT v: 165; my emphasis).

According to Descartes here, the fruitfulness of metaphysical questions (i.e. pure-intellect-activity) is exhausted by the contents of the *Meditations*. The metaphysical work has already been done, and nothing more of value is left to be obtained through pure-intellect-activity.[10] Instead, we, along with Descartes himself (as he specifies in the passages addressed above), should concentrate on the study of 'physical and observable things'. That is, we should engage ourselves in the kind of activity that integrates the intellect with the imagination (for producing and manipulating images of the observed things[11]) and with the senses (for observation itself). This IIS-activity provides 'abundant benefits', and it is in search of these benefits that we should spend our study time.[12] The implication is clear: the benefits that are available through pure-intellect-activity have already been all but exhausted by the *Meditations*, and any further work on metaphysics would be fruitless. The world of physical things, on the other hand, in all its vastness and complexity, still contains a wealth of knowledge yet to be obtained – and it is through IIS-activity that this knowledge can be acquired.

5.2.2.3 Pure-intellect-activity and the spoiling of the mind

Here is a closely related, but separate, reason for the rule of knowledge acquisition. It feeds into reading (b). In addition to being detrimental to the acquisition of knowledge insofar as it takes time away from IIS-activity, according to Descartes, overuse of pure-intellect-activity is deleterious to our ability to perform effective IIS-activity the rest of the time. In the *Conversation*, Descartes reiterates the warning about pure-intellect-activity that he gave Elisabeth five years previously. While he told Elisabeth that the

[10] That's assuming, as of course Descartes does, that we buy into his system.

[11] Galison 1984 provides an excellent account of the role of the imagination in Descartes's construction of micromechanical explanations of physical phenomena.

[12] In the passage above, Descartes doesn't make it entirely explicit whether these are benefits in the realm of knowledge acquisition, or in the realm of everyday life and health. But, given his focus on 'study' here, and given the strong parallels with his claims to Elisabeth and Chanut, it does seem that knowledge acquisition is what he has in mind.

harm of focusing on metaphysics lies in its hindering the study of observable things[13], he specifies to Burman that the study of metaphysics actually makes the mind 'unfit [*ineptum*] to study' observable things. This seems stronger (although the remark to Elisabeth could also be read in this light): he does not specify why, but Descartes appears to be claiming that too much metaphysics will spoil the mind, in some way, for more productive activities.

5.2.3 Summary

Reading (b) of Descartes's knowledge acquisition rule holds: pure-intellect-activity is less fruitful than IIS-activity, and he thus allocates himself only a few hours a year to it, while suggesting that *we* ought to do even less and involve ourselves in pure-intellect-activity only once in our lives (if we too are interested in acquiring knowledge). Pure-intellect-activity is less fruitful than IIS-activity because of diminishing returns: all the knowledge it is capable of producing is already available in the *Meditations*, and dedicating any more time to it would be futile. According to Descartes, in addition to being a distraction from more productive study, focusing on pure-intellect-activity diminishes our capacity to investigate the natural world productively – that is, to investigate it through the integration of intellect, imagination, and sensation.

5.3 IIS-integration and natural philosophy

In §5.2.1 (p. 115 above), a third possible reading of Descartes's knowledge acquisition rule was mentioned, but not assessed: (c) it could be that Descartes spends so much more time on IIS-activity than on pure-intellect-activity simply because IIS-activity is significantly more time-consuming than pure-intellect-activity. We have already established that reading (b) holds (IIS-activity is afforded more study time because it is more fruitful than pure-intellect-activity). That reading is by no means incompatible with (c): IIS-activity could be both more fruitful and, for independent reasons, more time-consuming than pure-intellect-activity. If we look at what is involved in using IIS-activity to investigate physical, observable things, then it will turn out that (c) does indeed hold. In this section, I am going to argue that, for Descartes, IIS-activity largely involves experiments, observations, data collection and analysis, and so on. That is, IIS-activity is time-consuming because it involves a wide range of laborious processes. In fact, as we might expect from Descartes's knowledge acquisition rule, IIS-activity

[13] The original French (translation quoted on p. 117 above) is, '[. . .] il ne pourrait si bien vacquer aux fonctions de l'imagination & des sens' (AT iii: 695).

does the great majority of the work in investigating the natural world. So let's start with what IIS-activity does not involve.

5.3.1 What IIS-activity does not involve

What IIS-activity does not involve – and, by contrast, what pure-intellect-activity does involve – is knowledge of fundamental metaphysics, or first philosophy. We can see this in an exchange between Descartes and Gassendi in the Objections and Replies, in which Descartes clarifies exactly what he takes the senses and imagination to be incapable of telling us. In Meditation Six, Descartes lists some experiences 'which gradually undermined all the faith [he] had in the senses' (CSM ii: 53; AT vii: 76). The first experience on his list is that of deceptively shaped towers:

> [s]ometimes towers which had looked round from a distance appeared square from close up
>
> (CSM ii: 53; AT vii: 76).

Now, Descartes brings this up as an example of how the senses can be fooled, and consequently as part of the impetus for scepticism about the ultimate veracity of the knowledge available through sensation. It is precisely that scepticism that makes the project of the *Meditations* necessary for obtaining a guarantor of truth. On the face of it, that ought to make the tower example antithetical to the use of integrated IIS-activity in natural philosophy. But, the visual deception problem in the example contains its own solution, and it is a solution that is within sensation: the tower might look round from far away, but all we need to do is move closer, and we will discover that it is square. The initial round appearance of the tower is still evidence for Descartes that sensation can be deceptive, of course, but, at least in this case, the correction of that deception comes from more sensations.

Gassendi brings Descartes up on just this point in the fifth set of objections, where he writes,

> I have no intention of starting an argument here about the truthfulness of the senses. For although there is deception or falsity, it is not to be found in the senses; for the senses are quite passive and report only appearances, which must appear in the way they do owing to their causes. The error or falsity is in the judgement or the mind, which is not circumspect enough and does not notice that things at a distance will for one reason or another appear smaller and more blurred than when they are nearby, and so on. Nevertheless, when deception occurs, we must not deny that it exists; the only difficulty is whether it occurs all the time, thus making it

> impossible for us ever to be sure of the truth of anything which we perceive by the senses.
>
> [. . .] [I]t seems to be quite uncontroversial that when we look at a tower from nearby, and touch it, we are sure that it is square, even though when we were further off we had occasion to judge it to be round, or at any rate to doubt whether it was square or round or some other shape
>
> (CSM ii: 230–1; AT vii: 332–3).

Gassendi's point is that we needn't give up faith in the senses just because a tower might look round from afar and square close up, and the suchlike. Sensation does not mislead: it merely presents us with appearances; it gives us the phenomena. And we can check up on those phenomena simply by acquiring more sensations: we walk up to that tower and we see, and feel, that it is square. In his reply, Descartes reasserts that sensory deceptions do indeed give him cause for scepticism:

> [y]ou maintain that we never suspect any falsity in situations where we have never detected it, and hence that when we look at a tower from nearby and touch it we are sure that it is square, if it appears square. You also maintain that when we are really awake, we cannot doubt whether we are awake or asleep, and so on.[14] But you have no reason to think that you have previously noticed all the circumstances in which error can occur; moreover, it is easy to prove that you are from time to time mistaken in matters which you accept as certain
>
> (CSM ii: 264; AT vii: 385–6).

Descartes's message to Gassendi here is that checking phenomena through the acquisition of more sensations is not sufficient to rule out scepticism about whether our senses might be fundamentally deceptive; if sensations really can't be trusted, getting more of them will be no help. Consequently, the *Meditations* project is still needed. But then Descartes goes on to qualify exactly what this scepticism is about:

> when you come round to saying that 'at least we may not doubt that things appear as they do', you are back on the right road: I made this very assertion in the Second Meditation. *But the point at issue in the present context concerned the truth* [*veritate*] *about the things located outside us*
>
> (CSM ii: 264–5; AT vii: 386; my emphasis).

Descartes agrees with Gassendi that sensation is not deceptive with respect to

[14] Gassendi had written, 'since during our lives we are alternately awake or dreaming, a dream may give rise to deception because things may appear to be present when they are not in fact present. But we do not dream all the time, and for as long as we are really awake we cannot doubt whether we are awake or dreaming' (CSM ii: 231; AT vii: 333).

appearances, and he specifies the particular point on which they do disagree: they disagree when it comes to the *truth* about external things. This is not the most transparent phrasing on Descartes's part – 'the truth about the things located outside us' is rather vague: we might well want to ask him what it is, in particular, about external things that gets to count as the relevant truth in this case. Given that appearances do not count as the truth, it is not immediately clear what does.

The relevant truth about any particular external thing is that it exists with its particular essence: the truth about the square tower is that there is something with the essence 'square tower' that really does exist in front of me. We can see why by a looking at a passage from Meditation Six, in which Descartes uses the same construction. There, he distinguishes the knowledge acquired as a union through the senses with that acquired through pure-intellect-activity:

> [m]y sole concern here [in this passage] is with what God has bestowed on me as a combination of mind and body. My nature, then, in this limited sense, does indeed teach me to avoid what induces a feeling of pain and to seek out what induces feelings of pleasure, and so on. But it does not appear to teach us to draw any conclusions from these sensory perceptions about things located outside us without waiting until the intellect has examined the matter. For *knowledge of the truth* [*verum scire*] *about such things seems to belong to the mind alone, not to the combination of mind and body*
>
> (CSM ii: 57; AT vii: 82–3; my emphasis).

So Descartes is making a distinction between what the senses can tell us and the 'truth' they can't access – and hence, of course, the truth we should be sceptical about the senses' being able to acquire. He goes on to explain what this involves:

> I misuse [the senses] by treating them as reliable touchstones for *immediate judgements about the essential nature of the bodies located outside us*; yet this is an area where they provide only very obscure information
>
> (CSM ii: 57–8; AT vii: 83; my emphasis).

There are two things to note here: (1) what is unavailable through the senses is knowledge of the essential nature of external things, and (2) the unreliability of sensation is confined to its use in judgements that are immediate. Let's deal with (1) first. In the previous passage, Descartes linked the truth about external things to knowledge available to the mind alone and not to the senses. In the passage that follows on from it (i.e. the passage quoted immediately above), he tells us that the

knowledge unavailable to the senses is that of the essential nature of external things. On that basis, the relevant truth about external things must be their essential nature.

Given that, the next question is what gets to count as the essential nature of an external thing. We know already, from earlier in the reply to Gassendi, that Descartes thinks the senses have access to the appearances of things. His famous illustration of stripping away appearances to get to (what presumably counts as) the essential nature of some external thing is his treatment of wax at the end of Meditation Two. He starts from the sensory phenomena particular to a specific piece of wax ('it has not yet quite lost the taste of the honey; it retains some of the scent of the flowers from which it was gathered; its colour, shape and size are plain to see; it is hard, cold and can be handled without difficulty; if you rap it with your knuckle it makes a sound' (CSM ii: 20; AT vii: 30)). These he eliminates one by one, removing whatever is inessential. After having relieved the wax of all its contingent appearances, here is what remains:

> [l]et us concentrate, take away everything which does not belong to the wax, and see what is left: merely something extended, flexible and changeable
>
> (CSM ii: 20; AT vii: 30–1).

This is the fundamental essential nature of the wax: extension, flexibility, and mutability.[15] This is the truth that is not immediately available through the senses: the external thing's basic ontological properties, or attributes, in respect to which, the phenomena available to sensation are, at most, accidents. So the essential nature that is derived here is not what is directly accessible through the senses – that is, the taste, smell, hardness, etc. particular to that piece of wax in that particular context. Those are accidental and inessential. And it is not a truth available through the imagination, either, since the wax could undergo an indefinite number of mutations while still remaining the same wax, and 'I am unable to run through this immeasurable number of changes in my imagination'. Hence,

> I would not be making a correct judgement about the nature of wax unless I believed it capable of being extended in many more different ways than I will ever encompass in my imagination. I must therefore admit that the nature of this piece of wax is in no way revealed by my imagination, but is perceived by the mind alone
>
> (CSM ii: 21; AT vii: 30–1).

[15] Note that there are accidental properties that are essential, at some higher level, to the particular piece of wax in front. I might, for instance, want to distinguish the red wax from the white. Descartes makes it clear that these are not the kinds of things that concern pure-intellect-activity.

So, this is the kind of truth about a thing located outside us that requires pure intellection. Knowledge of basic ontological properties is the preserve of the intellect, and not of sensation or imagination. As Descartes puts it, far more bluntly, in the Principles: 'sensory perceptions [. . .] do not, except occasionally and accidentally, show us what external bodies are like in themselves' (2/3; CSM i: 224; AT viiiA: 41–2).

Descartes concludes the wax example in the *Meditations* by noting the deceptiveness of ordinary speech with respect to external things. Ordinary speech, in this context, deals in sensory knowledge.[16] And its deception consists in implicit judgements of the actual existence of some external thing with such-and-such an essential nature, independent of our sensations:

> [w]e say that we see the wax itself, if it is there before us, not that we judge it to be there from its colour or shape; and this might lead me to conclude without more ado that knowledge of the wax comes from what the eye sees, and not from the scrutiny of the mind alone. But then if I look out of the window and see men crossing the square, as I just happen to have done, I normally say that I see the men themselves, just as I say that I see the wax. Yet do I see any more than hats and coats which could conceal automatons? I *judge* that they are men. And so something which I thought I was seeing with my eyes is in fact grasped solely by the faculty of judgement which is in my mind
>
> (CSM ii: 21; AT vii: 32).

In ordinary conversation, we say we see the wax. We do not say we see a particular colour in a particular shape and size (or taste a honey-flavour, or smell a flower-like scent). And, in doing so, we imply that what we see is the wax itself, in its essential nature – just as we would say that we see men outside, when the phenomena by themselves would be equally consistent with suitably attired automata.[17] So, this is the other aspect of the wax that is only available through intellection, and not through sensation or imagination: knowledge of its *independent* existence as an external thing with its essential nature.

[16] *Cf.* the reference to ordinary conversation in Descartes's discussion of the union, and the sensory grasp thereof, with Elisabeth (28 June 1643; CSMK: 692). See also §5.2.1, p. 114 above.

[17] Wagner (1995: 170) points out that the Latin, '*judico homines esse*', which CSM renders as 'I *judge* that they are men', could just as well be translated as 'I judge that there are men there'. The latter version emphasises the existential attribution in the judgement, which CSM obscures by adding an already existent 'they' of which an essential nature ('men') is predicated.

This, then, is what sensation and imagination cannot do. They cannot tell us about the essential natures of external things, where 'essential nature' is understood in terms of basic ontological properties. And they cannot tell us whether those external things actually exist, independent of our sensations. In other words, what sensation and imagination cannot do is first philosophy.[18] They cannot do metaphysics (at least, not metaphysics of the kind espoused in the *Meditations*).[19]

5.3.2 What IIS-activity does involve

When Descartes discusses the misuse of the senses in Meditation Six, he specifies that they are unreliable for 'immediate judgements about the essential nature of the bodies located outside us' (CSM ii: 57–8; AT vii: 83). In the previous section, we looked at the 'essential nature' side of Descartes's claim. Let's move to the immediacy restriction here. Sensations are fundamentally fallible, according to Descartes, when used to judge essential natures of external things, but only when used by themselves, with no mediation.[20] For Descartes, knowledge of essential natures requires intellection, so whatever mediation is involved here would have to come from the intellect. Knowledge of essential natures is not available to sensation and/or imagination taken alone, then – but IIS-activity is the integration of sensation and imagination with the intellect. In other words, IIS-activity is all about mediation. So can sensation (and imagination) be involved in acquiring knowledge about external things? The answer to that is assuredly yes, as long as they are integrated, to some degree, with intellection. That is, sensation and imagination are involved in knowledge of external things as long as the intellect is able to make judgements as to the independent existence of the things presented through sensation and imagination.

In Descartes's coats-and-hats example, the sensations involve nothing but the appearances. Within sensation itself, there is no judgement as to the nature or existence of the external things: it falls to the mind to judge that there exist things with

[18] In the First Replies, Descartes writes, 'we must never ask about the existence of anything [*an sit*] until we first understand its essence [*quid sit*]' (CSM ii: 78; AT vii: 107–8). The context there is the proof of God's existence, and Descartes's point is that first philosophy involves establishing first the essence of a thing and then whether a thing of that essence actually exists. See also (Wagner 1995).

[19] This is the other side of what Newman calls Descartes's 'Intellection Reliability Thesis' ('The intellect is a reliable basis for judgments about the nature of reality' (2005: 192)).

[20] The Latin is *immediate*, i.e. 'without mediation', rather than 'instant'.

the essential nature of men outside, crossing the square. And since the judgement involved is purely intellectual, it makes a good deal of sense to read the passage as an affirmation of the complete absence of sensation (and imagination) in matters of the essence and existence of external things. To a certain extent, that must be the case: the final arbiter of essential and existential truths must always be the intellect for Descartes. But that certainly does not mean that sensation and imagination play no part in acquiring knowledge about external things.

Sensation and imagination in themselves might not be reliable guides to the essential natures of external bodies, but, for humans, they are nevertheless indispensable in acquiring knowledge about almost everything (on the reading I give in this dissertation, knowledge of God would be the only true exception[21]). In the case of the hats and coats, although it was the mind that judged there to be men in the square, that judgement was not pulled out of thin (mental) air. It was neither arbitrary nor self-caused: the judgement is prompted by, and based on, the sensations involved in observing the square (or prompted by and based on images from the imagination, if Descartes is being disingenuous about his framing of the example). Indeed, in the Sixth Replies, Descartes calls this kind of judgement the 'third grade of sensory response', while noting that the judgement itself is intellectual (AT vii: 437–9).

That is to say, we would not think there were men outside if we did not see the coats and hats. Similarly, we would not judge that a piece of wax, with its essential nature (extension, flexibility, and mutability), was in front of us in the absence of certain sensations. In a way, this is rather trivial: of course we, and Descartes, cannot acquire any knowledge about external things without some – at least initial – input from the senses. What is not trivial is its demonstration of just how limited pure-intellect-activity is. When almost all the knowledge we can acquire will need at least partial integration of the senses and/or the imagination along with the intellect, Descartes's knowledge acquisition rule starts to make a lot of sense.

Of course, this does not mean that everything, aside from theology, in Descartes's philosophy always requires only IIS-activity. Once we have had some relevant sensations, there is a fair amount of pure-intellect-activity work that can be done to establish the essence and existence of external things in general. And once we have derived a notion of mind from the union, pure-intellect-activity can prove its existence

[21] Knowledge of thought and extension would not be *entirely* sensation-free, on my reading, given Ch. 4's argument that, for humans, notions of thought and extension must be derived through analysis from the notion of the union.

and tell us about its essential nature. Hence the *Meditations*' treatment of extension and thought respectively. In those cases, some initial prompting might be required from the senses, but the integration of sensation and/or imagination is not needed for the subsequent work, which can be done by pure-intellect-activity alone. The issue is just that, as the knowledge acquisition rule suggests, there is not a great deal more for pure-intellect-activity to do beyond this.

Where IIS-activity really comes into its own is in dealing with the particularities of natural phenomena, rather than with the generalities of first philosophy. IIS-activity might have only a tiny, initial role to play in telling us about, say, the divisibility of extended substance in general, but it is very useful – throughout the process – for finding out how hearts or eyes or rainbows work. Indeed, this is how Buchwald characterises Descartes's method in his study of his investigation of the rainbow in the eighth discourse of the *Dioptrics*: 'we begin with an observation and then try to manipulate the experimental conditions in order to pin down the factors that will alter the effect we are interested in' (2008: 5). What IIS-activity involves, then, is observational and experimental investigation of the world of physical things.[22] This is on a continuum with, if generally more sophisticated than, walking up to the tower to find out that it is really square rather than round. This kind of work requires the senses, for both observation and manual intervention in the world, but it also requires the imagination (for at least the initial representation of the physical situation) and the intellect (to judge the essential natures involved).

In a letter sent the year before he wrote the *Meditations*, Descartes tells Mersenne that

> the nature of heaviness is a purely factual question, that is to say, a question that can be decisively answered [*determinée*] by human beings only in so far as they are able to perform some experiment [*experience*]
>
> (to Mersenne, 13 July 1638; CSMK: 112; AT ii: 224).

What is in question here is the nature of heaviness. Knowledge of natures is supposed to be available only to the intellect, but Descartes describes the nature of heaviness as purely factual – as something, he explains, that can only be determined through experiment. In the letter, he then goes on to describe a suitable experiment and various observations. Determining the nature of heaviness, according to this methodology, involves a process much like getting closer to the tower to check its shape. This fits

[22] IIS-activity might also be useful in the investigation of thinking substance, I suspect, albeit to a more limited extent – Ch. 4 of this dissertation might well be summed up thus: for humans, Cartesian meditation will always find its starting point in IIS-activity.

perfectly with the knowledge acquisition rule, and with what we have seen so far about IIS-activity. Performing those experiments and making those observations is time-consuming, because it involves the intricate and messy work of intervening in the physical world, of gathering information, and of waiting for observations. It is also productive (because it is this kind of activity that is supposed to let us find out about heaviness, and a tremendous number of other things). It also involves no shade of pure-intellect-activity.

That Descartes makes use of experiment is nothing new. While it might once have been the case that he was read as propounding a purely deductive, a priori method in science, recognition of his experimentalism has been a commonplace for a long time now.[23] What might be slightly more controversial is to align this with his knowledge acquisition rule, in that doing so ascribes the vast majority of his study time to experimentation and similar or related activities. Even this is not unprecedented, though. In the introduction to his *Descartes' Philosophy of Science*, Clarke claims that his approach, in the book, is to understand Descartes as, primarily, a practicing scientist, who 'wrote a few short and relatively unimportant philosophical essays' (Clarke 1982: 2). In support of this (apparently at least partially polemical) position, Clarke cites a couple of the passages that mention the knowledge acquisition rule, alongside other evidence that Descartes considered his achievements in what we would think of as science above those in first philosophy (1982: 3–4).

The reading of the knowledge acquisition rule that I have been giving in this chapter does not support Clarke's claim about the unimportance of Descartes's work on first philosophy. Pure-intellect-activity is allocated, and consumes, far less of Descartes's study time than IIS-activity because it is a far less fruitful use of it (and, secondarily, because it is less time consuming). But that lack of productivity is not absolute; it comes in the form of diminishing returns. Pure-intellect-activity was immensely productive within a relatively restricted area of knowledge: it gave Descartes certainty about the essential natures of various fundamental things – his own mind, God, extended things, and so on. After having established that much, however, there is little left for pure-intellect-activity to do. As Simmons puts it (although with an eye towards everyday life rather than acquiring knowledge in natural philosophy),

> [i]t may behoove us to meditate our way into the posture of a disembodied angel once in a lifetime to discover important truths about God, the soul, and the fundamental nature of body. The *Meditations* is written to be our guide in that quest.

[23] See p. 112 above.

> But when our meditating is done, we must return to our embodied lives and trust the senses to be our guide
>
> (2014: 275).

If Descartes wants to gain knowledge about the world beyond first philosophy, he has to bring in sensation and imagination. What his rule of knowledge acquisition tells us is that IIS-activity is the most productive use of his time. If he wants to know about the world, he needs to do experiments, make observations, perform dissections. This, then, is what IIS-activity does involve. And this is what it does for Descartes's project of knowledge acquisition in natural philosophy – that is, just about everything.

5.4 IIS-activity, reductionism, and nonreductionism

5.4.1 Reductionism and the role of the intellect

A curious thing about sensation, in the Cartesian world, is that it deals in composites (or wholes). Descartes tells us that sensations are usually confused, rather than distinct – 'quite literally *con-fused* with something else', as Nelson neatly characterises it by highlighting the Latin etymology (1997: 167). That is, they tend to be joined together; they tend not to come divided up into their most basic constituents. It is the role of the intellect to do that division, to reduce the confused unity down to distinct ideas. In the Sixth Replies (in response to the comment that neither the real distinction between mind and body nor the existence of God seem as self-evident as do basic mathematical truths, and as such might be prejudices of his own), Descartes writes,

> [i]t is true that, before freeing myself from the preconceived opinions acquired from the senses, I did perceive correctly that two and three make five, and that if equals are taken from equals the remainders are equal, and many things of this kind; and yet I did not think that the soul of man is distinct from his body. But I do not find this surprising. For I can easily see why it happened that, when still an infant, I never made any false judgements about propositions of this sort, which everyone accepts; the reason was that I had no occasion to employ these propositions, since children do not learn to count two and three until they are capable of judging whether they make five. But, by contrast, I had from my earliest years conceived of my mind and body as a unity of some sort (for I had a confused awareness that I was composed of mind and body). It happens *in almost every case of imperfect knowledge that many things are apprehended together as a unity, though they will later have to be distinguished by a more careful examination*
>
> (CSM i: 299–300; AT vii: 445; my emphasis).

Prior to the passage above, Descartes spends several pages on examples of how he reached various conclusions through this careful examination. He discusses the sensation of seeing a stick thus:

> suppose that, as a result of being affected by this sensation of colour, I judge that a stick, located outside me, is coloured; and suppose that on the basis of the extension of the colour and its boundaries together with its position in relation to the parts of the brain, I make a rational calculation about the size, shape and distance of the stick
>
> (CSM i: 295; AT vii: 437).

The unity of the sensation gets broken down into judgements and rational calculations about low-level properties of the extended substance involved. Judgement, we know, is mental (see §5.3.1); the reasoning involved, of course, 'depends solely on the intellect' (CSM i: 295; AT vii: 438). And so we end up with separate judgements about the existence of an external stick and of a colour, alongside calculations (and presumably judgements based on those calculations) about the size and shape of the stick, and about its position relative to the viewer.[24] In this way, through 'careful examination', con-fused ideas are separated, and the unity that was the original sensation gets reduced to simple component ideas.

The intellect has other roles to play in IIS-activity, besides the reduction itself. Notably, it has to choose how to weigh up differing sensations. The initial case of IIS-activity considered in this chapter was that of the square tower that appeared round in the absence of further sensory investigation (see p. 121 above). It was the acquisition of more sensations (getting closer to the tower to look again, and touching it in Gassendi's example) that revealed the tower's true shape. In the Sixth Replies examples, Descartes gives us a concrete demonstration of how the intellect chooses between various such sensations to make a judgement on the fact of the matter. He brings up the familiar example of a straight stick that, visually, appears to be bent when partially submerged in water. This is an error that can be corrected with addition of another sensation: '[a]s a result of touching it, we may judge that the stick is straight' (CSM i: 296; AT vii: 439). But, it is not immediately apparent why the second sensation should correct the first. Why not say instead that touching the stick gave us cause to erroneously judge it to be straight, when we can plainly see that it is bent? On

[24] These are not the only components of the sensation. Descartes also decomposes the intervening physical systems between the stick and the viewer: 'rays of light are reflected off the stick and set up certain movements in the optic nerve and, via the optic nerve, in the brain' (CSM i: 295; AT vii: 437).

the level of the sensations themselves, there seems to be no means of choosing between them. This is where the intellect comes in:

> the sense alone does not suffice to correct the visual error: in addition we need to have some degree of reason which tells us that in this case we should believe the judgement based on touch rather than that elicited by vision
>
> (CSM i: 296; AT vii: 439).

On this account, the intellect is what ultimately integrates all those sensations gained through experiment, observation, and so on.[25] The intellect is what decides the epistemic weight of each. Exactly how it does that, Descartes does not specify here. But at least one instance has already been covered in this chapter: the investigation of the piece of wax (see p. 124 above). There, Descartes starts from the con-fused sensations he has of the piece of wax he tells us is in front him: it tastes of honey, it smells of flowers, it is cold and hard, and so on (AT vii: 30). The question he is interested in this particular case is that of the fundamental essential nature of the piece of wax. His approach is to reduce his sensations to their constituents and to test them for expendability, in order to decide whether they belong to the wax's essential nature. In the example, part of this testing involves an empirical component:

> I put the wax by the fire, and look: the residual taste is eliminated, the smell goes away, the colour changes, the shape is lost, the size increases; it becomes liquid and hot; you can hardly touch it, and if you strike it, it no longer makes a sound
>
> (CSM ii: 20; AT vii: 30).

That these sensory phenomena can be eradicated while the wax still remains the wax is evidence for Descartes's judgement that they are inessential to it. That judgement is itself, of course, something that belongs to the intellect. Another part of the testing is framed more straightforwardly as intellectual (although it presumably leads on from the sensory testing): '[l]et us concentrate [*attendamus*], take away everything which does not belong to the wax, and see what is left' (CSM ii: 20; AT vii: 30–1). What is left is, again, just extension: that is the lowest-level essential nature of the piece of wax. Descartes arrives at this conclusion – that is, he makes the judgement that extension is what counts when it comes to the fundamental essential nature of the wax – through a process of reduction in which everything eliminable is eliminated, until we reach the lowest level (which we recognise as the lowest level exactly because it cannot be eliminated). This in itself does not individuate the particular piece of wax; what it does

[25] See Garber (2001a), who, working from the *Discourse*, emphasises deduction: 'experiment is [. . .] part of the step preliminary to making a deduction' (2001a: 102; emphasis removed).

is tell us about the truth of the nature of the wax that we experience confusedly through the senses.

We see another instance of how the intellect chooses in Descartes's rejection of psychistic accounts of various biological phenomena (more on this in Chs 2, 3, and 6). In the *Treatise on the Passions of the Soul*, Descartes writes,

> [i]n this way we shall avoid a very serious error which many have fallen into [. . .]. The error consists in supposing that since dead bodies are devoid of heat and movement, it is the absence of the soul which causes this cessation of movement and heat. Thus it has been believed, without justification, that our natural heat and all the movements of our bodies depend on the soul; whereas we ought to hold, on the contrary, that the soul takes its leave when we die only because this heat ceases and the organs which bring about bodily movement decay
>
> (a. 5; CSM i: 329; AT xi: 330).

While psychistic principles of movement and heat are not themselves present in sensations, Descartes is choosing a mechanistic account of the phenomena in preference to an account in terms of souls. The phenomena we get through sensation are, for instance, experiences of animals whose behaviour bears a strong resemblance to our own. Descartes brings this up most explicitly in the context of his denial of thought in animals[26]:

> I see no argument for animals having thoughts except this one: since they have eyes, ears, tongues and other sense-organs like ours, it seems likely that they have sensation like us; and since thought is included in our mode of sensation, similar thought seems to be attributable to them. This argument, which is very obvious, has taken possession of the minds of all men from their earliest age. But there are other arguments, stronger and more numerous, but not so obvious to everyone, which strongly urge the opposite
>
> (5 February 1649; CSMK: 365–6; AT v: 277).

Descartes opposes the 'obvious' interpretation of animal behaviour with other, 'stronger and more numerous' arguments. The first he appeals to is that animal behaviour is reducible to mechanical activity (AT v: 277). Similarly, he rejects a psychistic account of animal locomotion because there is no psychistic motive power available in his ontology for animal movement to reduce down to (see Ch. 4). He

[26] On the then-standard scholastic conception of life in terms of vegetative, sensitive and rational souls, animal thought and animal locomotion are closely related issues – so much so that, later in the letter to More, Descartes feels the need to specify, 'Please note that I am speaking of thought, and not of life or sensation. I do not deny life to animals' (5 February 1649; CSMK: 366; AT v: 278).

adopts a mechanistic account instead, exactly because animal movement can be reduced down to mechanisms that are available in his ontology. This is, broadly, the argument of the *Treatise on Man* and the *Description of the Human Body* (as well as the summary of *Man* in the *Discourse*, and the opening of *The Passions*). In this way, the intellect is responsible for account selection in IIS-activity, via reducibility (at least in part). As McMullin puts it, '[t]he explanations [Descartes] offers rely in the first place on the epistemic priority of clear and distinct ideas to certify the explanatory apparatus employed: bodies reduced to extensions and all the rest' (2008: 98).

In all these cases, the judgement is made on the basis of reducibility; that is, it is made on the basis of the decomposability of con-fused ideas into lowest-level constituents that are congruous with Descartes's dualist ontology. When it comes to animal locomotion or thought, this is because each of the choices involved is between a reducible account, on the one hand, and an irreducible account, on the other. That will not always be so. Descartes needs to choose between multiple equally reducible options to account for the colour of light in the rainbow.[27] Similarly, judging the half-submerged stick not to be bent is not necessarily a choice between reducible and irreducible.[28] But where the choice *is* between reducible and irreducible, reducibility is Descartes's benchmark for the intellect's choice between competing sensations, or between competing information derived or partially derived from sensations.

So, the role of the intellect in IIS-activity involves (at least) the reduction of confused ideas down to their distinct lowest-level components. It also involves assessing the relative merits of acquired sensations, where possible in terms of reducibility.[29] In this

[27] See Buchwald 2008, which argues that experiment is integrated into Descartes's methodology to an even greater extent (2008: 5).

[28] Although, conceivably, it could be: Descartes has a well developed reductionist account of optical illusion through refraction that can explain the error in the visual sensation; he has no equivalent account that could explain a tactile illusion in which a bent stick would feel straight.

[29] This is not an exhaustive list, of course. There are other things that the intellect can and will do in the context of IIS-activity, such as generating hypotheses or similar, which it can then decide between on the basis of information from the senses and imagination: 'I notice hardly any particular effect of which I do not know at once that it can be deduced from the principles in many different ways; and my greatest difficulty is usually to discover in which of those ways it depends on them. I know of no other means to discover this than by seeking further observations whose outcomes vary according to which of these ways provides the correct explanation [. . .] so the advances I make in the knowledge of nature will depend henceforth on the opportunities I get to make more or fewer of these observations' (CSM i: 144; AT vi: 64–5). See also Clarke

way, the intellect is supposed to get existential and essential truths out of obscure and confused sensations: there is a stick out there, and it has a certain size, shape, and so on; there is a stick in the water, and it's not bent.

5.4.2 Nonreductionism and knowledge acquisition

If the intellect is supposed to reduce the confused ideas gained via sensation and imagination down to their lowest-level components, and if it is supposed to judge existential and essential truths about external phenomena on the basis of reducibility, what happens when our senses present us with something irreducible? We already know that this is more than a hypothetical. The union is known through the senses (Ch. 4, §4.2), and our notion of it is not reducible to anything in the dualist ontology (Ch. 4, §4.2.1). But Descartes does unequivocally and explicitly affirm that we have a notion of the union. This ought not to be the case. As we saw in the previous section, the intellect affirms knowledge of existence on the basis of reducibility, so it should reject irreducibles. This works when Descartes has a choice between a psychistic account of bodily locomotion and a mechanical account: the mechanical account wins out thanks to its reducibility, and the psychistic account gets rejected. The trouble with the union is that Descartes has no reductive account of it to choose.

When faced with a phenomenon that is not reducible in the terms of your ontology, the obvious responses are either eliminativism about that phenomenon or, perhaps, to alter your ontology. Descartes himself does not opt for the radical latter, of course.[30] Eliminativism would seem to be the clear choice. Purely in the terms of the ontology Descartes has already established, the union is an impossible thing (because it is the combination and interaction of two incompatibles); eliminativism about impossible things seems a sensible course of action.[31] But, again, this is not the course that Descartes takes. He simply affirms the existence of the union and treats it as unproblematic. So, given that Descartes rejects nonreductive accounts in cases such as bodily locomotion (and fire, and vision, and so on) – that is, cases where he has a reductive alternative – we might well expect him to reject nonreductive accounts just as

1982 in particular, and, to an extent, Garber 2001a.

[30] Using trialism to 'fix' Descartes's union problem would be a version of this. See Ch. 4, p. 87 above.

[31] In Chapter Three, I argue that Descartes takes just this sort of eliminativist approach with respect to life; in Chapter Six (§6.4), I argue that this eliminativism is compatible with a weak metaphysical commitment to the existence of life as an irreducible.

readily even when he has no reductive alternative. But, in the case of the union at least, he does the exact opposite: he adopts a nonreductive account of the union with no apparent reluctance, and with no hint of concern.

What this shows, then, is that Descartes takes himself to be under no compulsion to reject all irreducibles. But this chapter is about knowledge acquisition: can we say he has *knowledge* of irreducibles? Does he have actual knowledge of the union? If by 'knowledge', we mean what Descartes called *scientia* or *science* of the sort characterised by CSMK as 'systematic knowledge based on indubitable foundations' (CSMK: 13, n. 1), it would seem rather quixotic to claim that he has *knowledge* of irreducibles. Whatever he might 'know' of irreducibles cannot be systematic, if reducibility is what confers systematicity in this case (to be irreducible in the terms of a system of knowledge is presumably to be outside that system; to be a member of a system of knowledge is presumably to be reducible in the terms of that system). By the same token, 'knowledge' of irreducibles cannot be based on indubitable foundations, exactly because it is not reducible to them. So Descartes cannot have this kind of knowledge of irreducibles.

On the other hand, it would be fairly perverse to claim that Descartes really has no knowledge, in our sense of the term, of irreducibles. He knows that there is such a thing as the union of mind and body. He knows that our sensations pertain to the union, and that it is self-preserving. And this is operational knowledge, too: he uses knowledge of the union to account for the passions (*Principles* 1/48), for instance.[32] So Descartes has some kind of knowledge of and about an irreducible. Descartes (necessarily) might not be able to have systematic knowledge based on indubitable foundations when it comes to irreducibles, but (if we take his account of the union seriously) he must be able to have some kind knowledge of them).

So, irreducibles do have a part to play in knowledge acquisition for Descartes. We know that there is at least one irreducible in the world that Descartes affirms, of which he claims knowledge, and that he thinks warrants at least minimal investigation. So that door is open: irreducibles are not excluded from Descartes's knowledge acquisition project. Determining exactly what that knowledge consists in, and how Descartes can legitimately have access to it, is the task of the next chapter.

[32] Is this just practical knowledge, then? It doesn't appear to be, given that knowledge of the union has metaphysical import. *Cf.* Simmons manuscript.

5.6 Conclusion

Standard readings of the *Meditations* take it that Cartesian knowledge acquisition consists in certainty gained through pure-intellect-activity, and that all else is knowledge not 'worthy of the name'. The certainty this involves is supposed to be conferred by reducibility to the elements of Descartes's dualist system. But analysis of the rule of knowledge acquisition that he describes more than once to Princess Elisabeth, as well to Burman, and, allegedly, frequently in conversation, shows that Descartes takes the major work of knowledge acquisition to be done elsewhere: most knowledge, for Descartes, comes about through the integration of sensation, imagination, and intellect (IIS-activity), with the former two bearing most of the heavy lifting, in the form of experimentation and observation. The knowledge acquisition programme of the *Meditations* is extremely limited by contrast, and Descartes concerns himself with it rarely and instructs those who would follow him to address it precisely once and then turn their attention over entirely to IIS-activity.

Chapter 6

Real irreducibles and knowledge acquisition: the union, teleology, and life

6.1 Introduction

As we have seen, Descartes requires the intellect to make the judgement on the reality, or existence, of any given external thing (§5.3.1), and the intellect makes that judgement on the basis of reducibility to the elements of Descartes's ontology (§5.4.1). Given this, it would be easy to conclude that thinking and extended substances and their modifications (and God) are all that is real for Descartes. If that is the case, then knowledge of the reality of any particular thing given through sensation is determined by its reducibility to a modification of extended substance – colour itself, for instance, is not real for Descartes, but the phenomenon is reducible to certain modifications of matter.[1] So, in the case of colour, there is something real that subtends the phenomenon, and its reality is established by its reducibility.

But, Descartes does commit himself to the reality of some things that are not reducible to his established substances and their modifications. Or, at the very least, he appears to commit himself to the reality of certain irreducibles. This chapter makes the case that this is more than just an apparent commitment – that it is a coherent position for

[1] Those modifications consist in the rotational movement of pieces of matter of the first element that propagate light, along with spin-inducing arrangements of corpuscles on the surfaces of bodies that reflect light. See Descartes's *Optics*, Discourse Eight.

Descartes to uphold the reality of some irreducibles. The argument relies on the conclusions of the previous chapter (see especially Ch. 5, §5.3.1) to show that the requirement for Cartesian knowledge to be reductionist applies only to knowledge of the independent existence of external things, with their particular essences. Consequently, knowledge need not be reductionist just so long as it is knowledge of the *non-independent* existence of a thing.[2] What this means concretely is that we cannot know anything about irreducibles in themselves; we can only know them in connection with ourselves, from a subjective standpoint. In Descartes's terms, our ideas of irreducibles can be perfectly clear, but they are always 'con-fused' (combined) with ourselves. This is the kind of knowledge that Descartes can use to patch the epistemic gaps in his dualism.

There are parallels between my approach here and Lennon's (2007) treatment of motion and bodily individuation in Descartes. Lennon takes Cartesian motion to be 'phenomenal', which he defines, for the purposes of his paper, as 'mind-dependent', and which he associates with 'what (merely) appears to be (the case)', rather than with 'what is (the case)' (2007: 29). He opposes the phenomenal to the real, on the basis that 'Descartes, I venture to say, never used the term "real" to mean anything but mind-independent' (2007: 30). That might well be so[3], but my concern is less with Descartes's use of the term than it is with how he treats irreducibles – my reading deviates from Lennon's in that it upholds the reality of non-independent existence: epistemic gaps in Descartes's dualism, I will argue here, do not necessarily confer unreality; and, 'what is the case' can be known subjectively as well as objectively. Descartes never indicates that he takes the union to be any less real than minds or bodies. Indeed, if the analysis in Chapter Four (§4.4) is right, then the union is more real than mind or body, within Domain_U. And, if the union can be both non-independent and real, then so might other irreducibles. I also differ from Lennon in taking the dependency in question to involve

[2] It might be objected that this is not knowledge for Descartes – that true knowledge requires clarity and distinctness. It is precisely my point, in both this and the previous chapter, to show that clarity and distinctness is required only for knowledge of the independent existence of external things with their particular essences. We can still have nonreductionist knowledge of the non-independent existence of things. And, after all, Descartes tells Elisabeth that we 'know' the union (AT iii: 692).

[3] Apparently, neither Lennon nor I have checked exhaustively.

the union rather than the mind: nonreductive knowledge of non-independent existence is acquired sensorily rather than intellectually.[4]

The chapter first makes its argument through an analysis of our knowledge of the union (§6.2). It is fairly easy to see how knowledge of the non-independent existence of something works in the case of the union: since I am the union that pertains to me[5], its existence independent of me is simply inconceivable. The rest of the chapter then extends this reading to two other potential irreducibles. First, I consider how the problem of Cartesian natural teleology can be understood as a problem of reducibility, and what that would mean for Cartesian knowledge of teleology in the physical world (§6.3). Descartes explicitly rejects any role for teleology in our knowledge of the physical world, and his extended substance lacks the resources for any compatible reduction of teleology proper.[6] But, as has often been noted, Descartes seems to rely on teleology fairly frequently, especially when it comes to issues connected to biology.

If we take his prohibition against natural teleology seriously, this seems to be a significant problem for him – but if we treat natural teleology as an irreducible, Descartes can still have knowledge of it. That knowledge will have to be of its non-independent existence; in practice, that means that our knowledge of teleology in nature will always be tied up with our own human ends (§6.3.4). It means that we can ascribe function to a body-part, for instance, but cannot know anything about what it would be for that part to have a function in our absence. Perhaps more counterintuitively, it means that we can ascribe health to animals, but can say nothing about what its health would be to the animal in itself.

Finally, the chapter comes back to the question of life itself. In Chapter Three, I made a case for Descartes's being an eliminativist about life. Here, I argue that the account of Cartesian nonreductive knowledge set out in this chapter can make better sense of Descartes's talk of life (§6.4). This does not override the conclusions of Chapter Three,

[4] This is why I specify non-independence rather than mind-dependence.

[5] As a human, I am the union that pertains to me (see Simmons 2011). If I am, as Descartes argues in Meditation Two, just a mind, then I am a necessary part of the union that pertains to me: independent of me-as-a-mind, that union would cease to exist. Either way, then, the independent existence of the union that pertains to me is both unknowable and nonsensical. See p. 145 below.

[6] There have been some attempts, in the literature, to allow him reductionist quasi-teleologies; on this, see §3.

however. It turns out that Descartes can eliminate life itself from his biology, while still maintaining a weak metaphysical commitment to life as an irreducible (§6.4.4).

6.2 The union

6.2.1 Knowledge of the union

In this section, I argue that Descartes treats the union of mind and body as a real irreducible. Given Descartes's criteria for knowledge acquisition, the irreducibility of the union ought to pose a considerable problem for our ability to have any knowledge of the reality of the union. That's because knowledge of the independent existence of any external thing with its particular essence can only be established by a purely intellectual reduction into the established terms of the ontology (Ch. 5, §5.3.1). The argument I make here is that the knowledge of the existence of the union that Descartes can allow is knowledge of the *non-independent* existence of the union. That is, I can have knowledge of the existence of the union that pertains to me only insofar as it is not independent of me; I can have no knowledge of the essence or existence of that union in itself, outside my experience of it.

6.2.2 The legitimacy of knowledge of the union

If the reading given in Chapter Five holds, the union of mind and body is both (a) irreducible to thinking or extended substances and their modifications and (b) real. We know that we acquire knowledge of the union purely through the senses (see Ch. 4, §4.2 and the extensive treatment in Simmons (manuscript)). Given the analysis of Descartes's rule of knowledge acquisition given in the previous chapter, knowledge of the reality of the union thus ought to be illegitimate. That's because there is no reduction (in the terms of Descartes's dualist ontology) available on the basis of which the intellect can make an existential judgement.[7] That, indeed, is the entire problem of

[7] At times, Descartes flirts with according the union the status of a substance (chiefly, by calling it a 'substantial union' (AT vii: 228; AT iii: 508)). Others in the literature have attempted to use this to reconcile the reality of the union with reductionist criteria for knowledge, by rendering the union the third substance of Cartesian trialism. If the union is a substance itself, then it is (of course) reducible to a substance, and so Descartes's means of knowledge acquisition remain consistent. But, I have argued that the application of substance metaphysics to the union involves the illegitimate extension of his dualism outside its domain of conceivability (Ch. 4, p. 87 above). In addition, we might well say that trialism is simply not Descartes's system. At the end of this section, I conclude that its inability to provide knowledge of the independent existence of the union is a limitation of Descartes's dualist system. A different system – a trialist system – presumably would not share that limitation.

the union. And yet Descartes proceeds to assert the existence of the union. Not only does he assert the existence of the union, but he does so in explicit recognition that the terms of his dualism are incapable of supporting any account of it.

We see this when he establishes the notion of the union as a primitive notion (Ch. 4, §4.2.1), and when he tells Elisabeth that her consternation over mind–body interaction is entirely due to having spent too much time thinking only within the dualist ontology[8], which has

> made Your Highness find obscurity in the notion we have of the union of the mind and the body. It does not seem to me that the human mind is capable of forming a very distinct conception of both the distinction between the soul and the body and their union; for to do this it is necessary to conceive them as a single thing and at the same time to conceive them as two things; and this is absurd
>
> (to Elisabeth, 28 June 1643; CSMK: 227; AT iii: 693).

As discussed in Chapter Five (§4.2.1), Descartes's point here is that we cannot understand the union while thinking in terms of thought and extension. The union, on the one hand, and dualism, on the other, can only be addressed through their own, mutually exclusive, domains of conceivability. The union, then, is necessarily irreducible in the terms of the dualist ontology. And yet it 'is known very clearly' (to Elisabeth, 28 June 1643; CSMK: 227; AT iii: 692). What's more, the union is known very clearly '*by the senses*' (Ibid.; my emphasis). This kind of knowledge, available only through the senses, ought not to be possible. From Descartes's wax example, we concluded that what the senses and imagination could not provide was knowledge of the independent existence of an external thing with its essential nature. But what we seem to have here is precisely knowledge acquired exclusively through the senses of the existence of an external thing (the union) with its essential nature (it is a union of mind and body).

If Descartes does indeed allow sensory knowledge of an irreducible, then it seems there are two options for making sense of the situation. Either he abandons his criteria for knowledge acquisition when it comes to the union, or there is some way in which he can reconcile those criteria with our knowledge of the union. In the former case, there is little more to say: Descartes's dualism allows the intellect no reductive access to the union, but we have knowledge of it nevertheless. On this interpretation, Descartes has no means of bridging the dualism's epistemic gap with respect to the

[8] Or, in this case, that she has spent too much time engaged in pure-intellect-activity, to the exclusion of the senses.

union; it is something we know, but he can say nothing about how we know it. That would mean that we can have knowledge of irreducibles even in the absence of any criteria whatsoever for that knowledge: irreducibles are things we just know. This would be somewhat problematic, especially given Descartes's concern with the grounds for epistemology. It would be problematic because it allows for an unregulated means of knowledge acquisition, in which there are no clear criteria by means of which to distinguish a real irreducible from simple error. This need not be an insurmountable problem[9], but it would be better if we had a reading that allowed Descartes to maintain his knowledge acquisition rules and also apply them to our knowledge of the union. This is the second option.

6.2.3 Externality and independence

Te problem at stake in allowing Descartes legitimate knowledge of the union is that of how he can reconcile our sensory knowledge of the union with his criteria for knowledge acquisition. One possibility would be to focus on the externality criterion. In both Meditation Six (CSM ii: 57–8) and his response to Gassendi in the Fifth Replies (CSM ii: 264–5), Descartes specifies that the senses cannot tell us about the existence and nature of things located 'outside ourselves' (see pp. 122–123 above). The union might seem to be non-external – humans are, after all, unions. If it were the case that the union is not external, then its non-externality could allow us to have sensory knowledge of it without contravening Descartes's criteria for knowledge acquisition. That is not the case, however: when Descartes brings up the externality criterion, he does so within the domain of conceivability of his dualism, in which humans are not fundamentally unions but minds. In his response to Gassendi, Descartes is concerned with doubt about the veracity of the senses; throughout the *Meditations* and Replies, that doubt is just as applicable to my own body, and to my union with it, as it is to the world beyond my body. Similarly, when he raises the externality criterion in Meditation Six, he specifies that 'knowledge of the truth about such things seems to belong to the mind alone, not to the combination of mind and body' (CSM ii: 57; AT vii: 82–3). Within this domain of conceivability, then, the only non-external thing is the mind: Descartes means the union to be subject to the externality criterion.

So, the senses alone cannot give us knowledge of the independent existence of an external thing with its essential nature. And, when it comes to our purely sensory knowledge of the union, the externality criterion still applies, and we have no leeway

[9] For instance, as we saw with the round-seeming tower, a certain amount of error-checking can be done within the senses themselves.

with its existence or its essence (according to Descartes, it exists and we know its nature very clearly). If we are to reconcile Descartes's prohibition against sensory knowledge with our knowledge of the union, all that's left is the independence criterion. And, unlike the externality criterion, the independence criterion is not contravened by knowledge of the union: whether I take myself to be a union or just a mind, the union that I know (i.e. the one that pertains to me) does not exist independently of me. If I am a union, that union is me; if I am a mind, that mind is part of the union, making the union at least mereologically dependent on the mind. So, either way, when I have sensory knowledge of the union, what I have is knowledge of the existence of something external to my mind with its essential nature, where that existence is not independent of me.

This makes sense: as Descartes claims, I know the union that pertains to me very clearly; but, I can say nothing at all about what that union would be without *me* – that would be inconceivable. This is also consistent with something established in Chapter Four (§4.4): the domain of conceivability through which we understand the union is subjective, or egocentric, rather than an objective view from nowhere.[10] And it is subjective precisely because what the senses present us with are con-fused ideas in which we (in the form of the union of the mind with the body) are partially fused to our ideas of external things. In exactly this way, then, whatever my sensory knowledge is, it cannot be knowledge of external things with their essential natures existing independently of myself.

So it seems that there is a way to reconcile our sensory knowledge of the union with Descartes's commitment to the inapplicability of the senses to knowledge of the independent existence of external things with their essential natures: we can have sensory knowledge of the non-independent existence of external things with their essential natures. This might sound surprising, given that it runs so contrary to the characteristics of the kind of knowledge that Descartes is so careful to establish in the *Meditations* – knowledge that is well-grounded, reductive, and objective. But, in fact, it fits perfectly well with what Descartes writes to Gassendi about appearances (discussed on p. 122 above):

> when you come round to saying that 'at least we may not doubt that things appear as they do', you are back on the right road
>
> (CSM ii: 264–5; AT vii: 386).

[10] For clarity, the objective view is distinct from objective reality. See Ch. 4, n. 27, p. 106 above.

Descartes's claim at this point in the Reply is that we are not deceived about appearances just so long as we take them to be appearances and nothing else. It's when we start attributing *independent* existence to appearances (with their particular essences) that we run into trouble (Ibid.). In other words, we can have sensory knowledge of con-fused things just so long as we do take them to be con-fused. With an appearance such as colour, the situation is relatively simple: the appearance of, say, redness is indeed the appearance of redness, but Descartes also has the resources to give a reductive analysis of the con-fused idea of redness. That reductive analysis allows him to rule out the independent existence of some thing with the essence 'red' – and it provides knowledge of the independent existence of pieces of matter arranged in such a way as to be produce our con-fused idea of redness.

The redness scenario is not, of course, the scenario we get with the union. We know that the resources for a reductive analysis of the union are precisely what Descartes lacks. This does not mean that Descartes denies the existence of the union (absolutely not: he affirms its existence). It just means that our only knowledge of the union is at the level of con-fusion, specifically, its con-fusion with ourselves. This means that we know the union to be real and also irreducible within Descartes's system. Another way to put the same point is in terms of essence. For colour, we know (and have the means to know) that the essence of the appearance (red) is very different from the essence of the independently existing thing (certain arrangements of pieces of matter). In that case, we can talk both of the essence of the con-fused thing and of the essence of the independently existing thing. For the union, however, we know the essence of the con-fused thing very clearly, but we can say nothing about the essence of some union-thing independent of ourselves; the very notion is nonsensical.

6.2.4 Knowledge of the non-independent existence of the union

As we have seen, we can have purely sensory knowledge of the existence of the union with its particular essence. The union, then, is an irreducible that we can know to be real, albeit with our knowledge of it con-fused with ourselves. What we cannot have is knowledge of the existence or essence of any union-thing independent of ourselves. This is not a problem for Descartes. The inability to provide the latter kind of knowledge is simply a limitation of his dualist system (this is the 'epistemic gap' referred to in Chapters Four and Five). But in no way does that rule out all knowledge of the union. We can still know the union, and know it to be real. There are at least two outcomes of all this for Cartesian knowledge acquisition. First, it shows that Descartes does not rule out knowledge of things that are irreducible to the elements of his dualist

system (because the union is irreducible and we have knowledge of it). Second, on Descartes's account, it is possible to have such knowledge as long as it is knowledge of something con-fused, rather than an illegitimate judgement of the existence of some thing independent of ourselves. That is, the idea we have of the union is not clear and distinct; it is undoubtedly clear (we 'know it very clearly'), and it is con-fused.[11] This means that we can indeed have knowledge of the union, and that what that knowledge involves must be knowledge of the non-independent existence of something with the particular essence of a union of mind and body.

6.3 Teleology

6.3.1 Knowledge of natural teleology

Much like the union, teleology ought to be a significant problem for Descartes. He rejects knowledge of ends in the material world, and yet he makes repeated use of them in his natural philosophy. Descartes's apparently contradictory treatment of natural teleology has been a enduring problem in the scholarship.[12] In this section, I propose that we might understand teleology, for Descartes, as a real irreducible. That is, we can have knowledge of ends in the natural world in the same way that we can have knowledge of the union. That means that, while we cannot have knowledge of the independent existence of such ends, with their particular essences, we can have knowledge of ends insofar as those ends are not independent of ourselves. In other words, we can say nothing about, for instance, what the health of an animal is for the animal itself, but we can know about the health of an animal in some connection to human health. This means that Descartes's prohibition against knowing God's purposes still stands: if God has any such purposes, they exist independently of us; and, we have no knowledge of the independent existence of ends in the natural world.

[11] This might seem to undermine Nelson's interpretation of clarity, given that he takes obscurity (i.e. non-clarity) and confusion to be co-extensive (Nelson 1997: 169). But here we have a case of something that is, by definition, con-fused, but that Descartes also describes as being 'very clear'. We can reconcile this with Nelson's reading if we take the two terms to allow equivocation between domains of conceivability: within Domain_U, which is the domain Descartes is thinking within when he tells Elisabeth that we know the union very clearly, our notion of the union is clear (it does, after all, 'jump out at us' in the way that clear ideas are supposed). But, in the terms of Domain_D, our notion of the union can only be con-fused.

[12] See, e.g., La Porte 1928; Des Chene 2000a; Simmons 2001; Shapiro 2003; Gaukroger 2000; Hatfield 2008; Brown 2012; Detlefsen 2013; Manning 2013; Distelzweig 2015.

To say that the ends we see in nature exist non-independently of us might sound somewhat obscure. All it means is that we can know, say, the function of the lungs perfectly well, but we cannot legitimately know anything about the function of the lungs in a world devoid of humans. That is not to say, however, that the function of the lungs is illusory: lungs might well have a function in themselves, existing independent of us; Descartes's dualist system simply lacks the resources to tell us anything about the independent existence of such a function. If the reading of Cartesian knowledge of the union given above is correct, there should be no such problem with having knowledge of the non-independent existence of the function of the lungs. Consequently, treating teleology as a real irreducible, whose non-independent existence with its particular essence we can have knowledge of, provides epistemological grounds for projectionist readings of Cartesian natural teleology (as proposed in, e.g., Des Chene 2000a and Manning 2015). Because Descartes's reductionist account of knowledge acquisition confers knowledge of the reality of things on the basis of their reducibility, the apparent risk with projectionist readings of Cartesian natural teleology is that they deny the reality of natural teleology; if reductionist knowledge is all we can have, then teleology must be 'just' a projection. But if natural ends are real irreducibles, their reality remains intact. The irreducibility of such ends does not entail that natural ends are illusory: it implies only an epistemic gap in the dualist system. And this is a gap that Descartes has the resources to patch, through the same means of knowledge acquisition he employs for knowledge of the union.

6.3.2 The problem of natural teleology

Descartes's most well known rejection of teleology comes at the beginning of Meditation Four:

> since I now know that my own nature is very weak and limited, whereas the nature of God is immense, incomprehensible and infinite, I also know without more ado that he is capable of countless things whose causes are beyond my knowledge. And for this reason alone *I consider the customary search for final causes to be totally useless in physics; there is considerable rashness in thinking myself capable of investigating the purposes of God*
>
> (CSM ii: 39; AT vii: 55; my emphasis).

Similarly, in the Fifth Replies, he specifies further,

> [t]he function of the various parts of plants and animals etc. makes it appropriate to admire God as their efficient cause – to recognize and glorify the craftsman through examining his works; but *we cannot guess from this what purpose God had in creating any*

> *given thing*. In ethics, then, where we may often legitimately employ conjectures, it may admittedly be pious on occasion to try to guess what purpose God may have had in mind in his direction of the universe; but *in physics*, where everything must be backed up by the strongest arguments, *such conjectures are futile*. *We cannot pretend that some of God's purposes are more out in the open than others; all are equally hidden in the inscrutable abyss of his wisdom*
>
> (CSM i: 258; AT vii: 374–5; my emphases).

His argument is that our finite intellects cannot hope to grasp God's purposes; consequently, any attempt to explain natural phenomena through final causes would be a hopeless endeavour. We cannot, Descartes tells us, predicate our explanations on something that can only ever be a mystery to us. We might well wonder why Descartes jumps straight from teleology to God – it seems plausible that we could have final causes without making them the products of God's purposes. The problem with that is that, for Descartes, only minds can provide ends; extended substance does not have the resources to produce final causes itself. The final causes of artificial things are thus to be found in the purposes of their human designers; and, if natural things have final causes, they can only be found in the purposes of God (within the confines of the dualist system). In the Sixth Replies, Descartes tells us that, prior to distinguishing properly between body and mind, he

> thought that gravity carried bodies towards the centre of the earth as if it had some knowledge of the centre within itself. For this surely could not happen without knowledge, and there can be no knowledge except in a mind
>
> (CSM ii: 298; AT vii: 442).

In other words, Descartes takes it that a final-cause explanation (of the kind used by Aristotelians) of why bodies fall downwards involves the illegitimate attribution of mind-specific capacities to bodies: if they fall in order to reach the centre of the earth, they must know where they are going (otherwise, they wouldn't be falling *in order to* reach the centre of the earth). On Descartes's account, final causation requires some kind of knowledge of the end involved, and bodies cannot have knowledge of any kind. So extended substances lacks the capacities that make final causation possible: it is incapable of having the requisite knowledge.

Indeed, if Descartes does reject secondary causation[13], then, strictly speaking, extended substance in itself lacks the capacities to produce any sort of causation at all: for Descartes, all body–body causation is really God–body causation (see Ch. 4, §4.2.2.3). And since we cannot know God's purposes, it would be futile to attempt to account for

[13] See n. 18, p. 96 above.

natural, physical phenomena through final causation. Descartes makes this explicit in the *Principles*. Article 28 of Part One is titled '[i]t is not the final but the efficient causes of created things that we must inquire into', and this, he explains again, is because,

> [w]hen dealing with natural things we will, then, never derive any explanations from the purposes which God or nature may have had in view when creating them <and we shall entirely banish from our philosophy the search for final causes>. For we should not be so arrogant as to suppose that we can share in God's plans. We should, instead, consider him as the efficient cause of all things
>
> (1/28; CSM i: 202; AT viii: 15–6).

Since we have no access to God's plans, we can say nothing about the ends for which things in the natural world might take place, if indeed there are any such ends. If we want to explain natural phenomena within the dualist system, our only option is to look at the efficient causes. When faced with some phenomenon, we can only ask what God changes directly in making it happen; we can't ask why.

And yet, Descartes does make considerable use of teleology in explaining natural phenomena, biological phenomena in particular. Or, at the very least, he certainly appears to make use of teleology in doing so. His accounts of physiology and medicine frequently rely on what looks like highly teleological language, largely through his attributions of *usus*/*usage* or *officia*/*offices* to parts of the body: the 'true *function* [*usage*] of respiration is to bring enough fresh air into the lungs to cause the blood entering there [. . .] to thicken' (CSM i: 138; AT vi: 53; my emphasis); the 'upper part of the heart of an eel [. . .] *performs the same function* [*officio fungebatur*] in the eel as the right auricle does in the heart of a land animal' (CSMK: 96; AT ii: 68; my emphasis); when the body takes on the configuration of hatred, 'the stomach ceases to *perform its function* [*faire son office*], being inclined to regurgitate and reject the food we have eaten' (CSM i: 363; AT xi: 402; my emphasis); the muscles '*serve* [*servir*] to move the body' (CSM i: 335; AT xi: 341; my emphasis); and so on.

The apparent teleology goes beyond lexical choice, too. Descartes is eager to claim that the ultimate goal of his physiology – indeed, of all his work – is medicine, specifically the preservation of health (AT iv: 329). Health, however, is an end; as such, it it something that Cartesian bodies ought to lack the capacity to have. And, as Simmons (2001) has shown, health is not just a problem of teleology in its own right: the notion of health is also central to Descartes's physiological account of sensation; and the same goes for his similarly physiological treatment of the passions in the *Treatise on the*

Passions of the Soul. In none of these cases does Descartes attempt to justify, explain away, or otherwise account for his use of teleology.

So Descartes both excludes teleology from our knowledge of the natural world and unapologetically puts it to work in his explanations of biological phenomena. This bears more than a passing resemblance to his treatment of the union: in each case, something ruled out by his wider philosophy gets affirmed without explanation. There are two differences worth noting here. First, Descartes affirms the existence of the union explicitly, while his affirmation of teleology in the natural world is tacit at best. Second, while Descartes's dualism entirely lacks the resources to provide a reductionist account of the union, that's not the case for teleology. Descartes does have reductionist accounts of both anthropogenic and non-anthropogenic teleology. The former, as discussed above, comes down to activity towards ends known by minds; the latter comes down to God's purposes. Anthropogenic teleology is no problem, because the ends of minds are accessible to us. But God's purposes are inscrutable, and, hence, whatever non-anthropogenic teleology there may be in the natural world could only ever be mysterious.[14] So, Descartes's system certainly has the resources to provide a reductionist account of anthropogenic teleology. And, in a sense, it also has the resources to provide a reductionist account of non-anthropogenic teleology. It's just that the results of that account will always be beyond our grasp – and, consequently, it is entirely useless for the acquisition of knowledge.

The result of that inaccessibility is that the reduction of non-anthropogenic teleology that is possible in principle ends up being impossible in practice, within Descartes's system: final causes might rest in God's purposes, but we humans will never know them. And given that God's purposes are inscrutable, whatever non-anthropogenic teleology Descartes identifies in the natural world must either be an error on his part, or it must be something else. It could, perhaps, be that he is simply being careless with his use of teleological language, and with his identification of health. But, if so, he would be allowing a lot to rest on such carelessness, given the importance he places on medicine and the role he allows health in everyday life and in sensation. In addition, it is difficult to see how his account of physiology could possibly work in the absence of all ascription of function. So simple error seems an unlikely solution, which suggests that whatever is involved when Descartes invokes health, functions, or similar, it is not God's unknowable purposes. In that case, the in-principle reduction of teleology is

[14] Even the very existence of non-anthropogenic teleology would, presumably, be equally mysterious (because to presume that God has a specific purpose for any given thing is to pretend to share in his plans).

beside the point; something else must account for the (apparent) non-anthropogenic teleology in the Cartesian natural world.

6.3.3 Reductions of natural teleology

Recent scholarship has made several proposals for reductionist accounts of particular forms of teleology that Descartes appears to invoke. Such reductionist accounts address what Gaukroger (2000: 387) calls 'intrinsic goal-directedness', as opposed to the 'extrinsic goal-directedness' of God's purposes (or of anthropogenic teleology in the case of artefacts). These reductionist accounts tend to be eliminativist accounts as well[15], in that they aim to reduce the problematic apparent teleology to processes that are purely mechanical and that thus operate only through efficient causation. If they can show that all the causation involved is efficient, then there is no final causation involved; the assumption underlying this move seems to be that, without final causation, there is no true teleology. Thus, Shapiro (2003) argues both that health is reducible to the structural integrity of the body and that structural integrity is non-teleological (2003: 426). Similarly, Brown proposes a reduction of function to reciprocal dependencies between parts of the body, and argues that this allows for 'a non-normative, non-teleological form of functional explanation' (2012: 75). Hatfield (2008) suggests the possibility of a Lucretian selectionist account of function, but then rejects it for various reasons (not least because Descartes never so much as hints at holding such a position).

My intention here is not to prove that teleology is incontrovertibly irreducible for Descartes. If the reductionist interpretations do hold, then the particular forms of teleology they address are simply amongst the things Descartes treats reductively. What I want to show, instead, is that a reading in which Descartes takes teleology to be a real irreducible is coherent and has some advantages (notably, it makes sense of Descartes's casual treatment of teleology, and it provides grounds for projectionist accounts of biological teleology). All that said, of the reductionist accounts, it is not clear that Shapiro's, at least, does hold. She notes (2003: 433) the 'boundary problem' (Des Chene 2001: 132) that Des Chene identifies: extended substance, in itself, lacks the resources to ground a principled individuation of any particular

[15] That is not to say that all eliminativism is reductionist – §6.4.4 argues that eliminativism can be compatible with nonreductionism.

machine.[16] Shapiro (rightly) thinks that finding a way to define bodily boundaries purely within extended substance would provide Descartes with a means of defining health. Such a definition would allow health and ill-health to be determined in terms of the maintenance of that boundary. She proposes that a machine's 'stable intrinsic structure' will do exactly that job – without 'appeal to any extrinsic purpose' (2003: 435). For Shapiro, this stable intrinsic structure is what 'allows the thing to be put to some kind of work, of whatever kind that might be' (2003: 435). She stresses that the work it is put to need not be the work for which it was designed; as such, the account does not fall back on extrinsic ends.

On Shapiro's reading, a machine stops being the kind of machine it is if it loses, or changes, its 'stable intrinsic structure'. A machine's structure is both 'stable' and 'intrinsic' if it is the particular structure that determines that particular machine: for as long as that structure is maintained, it remains that machine. Hence, presumably, some alien entirely ignorant of the simple machines that anglophone humans call 'springs' could pick one up and use it to absorb impact, to transmit vibrations, or to help construct some kind of time-keeping machine (see 2003: 434). Shapiro's insight is that it is something about the intrinsic structure of the spring that lets it be put to those uses; if it were straightened out (thereby losing that structure), it would cease to be able to be put to work in just those kinds of ways. This structure is describable reductively, purely in material terms (in the way that we can describe the composition of the mechanism of a clock in terms of the arrangement of its cogs, springs, etc.[17]). The idea is that the apparent teleology of health can be reduced to the maintenance of this reductively describable structure.

The trouble is that this doesn't solve the boundary problem. The individuation here is still dependent on extrinsic ends, in that it depends on the uses to which some intentional creature wants to put it. What Shapiro shows is that those uses are not indifferent to certain features of material substance, in that there are some things we can do with a spring and some we cannot. But individuation does not need to be *purely* dependent on extrinsic ends in order for us to run into the boundary problem; it just requires extended substance in itself to be incapable of fully determining the boundaries of the body. It is true that there is something intrinsic to a spring that

[16] It is worth noting that the boundary problem might well also be an irreducible in its own right – and not just for biological bodies, but for any physical body. As Des Chene points out, it is not clear what, in extension itself, could do the job of defining the boundary of a body. *Cf.* Lennon 2007.

[17] For more on the composition of a mechanism –and the irreducibles *that* involves – see Ch. 1.

makes it suitable for some uses and unsuitable for others, but those uses do not exist within matter itself: they are the ends of intentional beings and, as such, are necessarily extrinsic to Cartesian extended substance. So while the structure itself is intrinsic to extended substance, the uses for which that structure is suitable or unsuitable are extrinsic.

Given that the particular structure that determines the particular machine is relative to the uses to which it can be put, Shapiro's solution to the boundary problem still requires extrinsic ends. Whether the spring is coiled up or straightened out makes no difference to extended substance in itself, which persists regardless; the structure only becomes salient if some intentional being comes along looking to absorb some impact, transmit some vibration, or build a clock. Consequently, on Shapiro's reading, extended substance in itself is still not capable of fully determining the boundaries of a machine, and the reduction fails. In the terms we've been using in this chapter, Shapiro's attempt to establish a reductionist account of health is an attempt to establish knowledge of the independent existence of bodily health. What she ends up showing, though, is the *non*-independent existence of bodily health: we understand health in connection with our own ends, via the boundary problem. This, of course, is entirely consistent with the kind of knowledge described in this chapter: knowledge of bodily health is the kind of knowledge we can acquire of irreducibles.

6.3.4 The projectionist reading of natural teleology

6.3.4.1 Projectionism

Of the rest of the literature, some draws out the teleology of Descartes's biology without looking for solutions to the problem (e.g. Distelzweig 2015, while some opts for some form of 'projectionist' reading. Under projectionist readings, Descartes can attribute teleology to material bodies by the projection of, or by comparison to, the human case. As Des Chene has pointed out, we humans get to be legitimately teleological, for Descartes, by virtue of our being unions.[18] Since minds are intentional, they can have ends; and since our minds are joined to our bodies, they can assign these ends, such as health or function, to those bodies, for the sake of the union. Thus, a human body is healthy insofar as it is able to play its part in maintaining the union.

[18] 'The union is a proper subject of teleological properties, and thus of normative predicates defined in terms of them. For the body-machine, health and sickness are external valuations, but for the union they are genuine properties' (Des Chene 2000a: 723).

This much is not problematic for Descartes. Animals, however, (and human bodies considered purely in themselves) still seem to be at least describable in terms of health; and Descartes still addresses animal and human body-parts in terms of function. But animals (and human bodies in themselves) do not have unions. Their teleology thus cannot come from their being joined to intentional minds. But what animal bodies do have is a distinct resemblance to the bodies of ensouled human bodies. (And human bodies in themselves look *exactly* like ensouled human bodies.) On the projectionist reading, we see teleology in the natural world because we project ensouled teleology onto bodies that have no intrinsic teleology of their own. In this way, we can say, for example, that an animal is healthy insofar as its state is analogous to that of a healthy ensouled human.

Des Chene outlines the projectionist reading thus:

> [t]he functional language that, like his opponents, Descartes uses to describe living things can be explicated only *as a projection of human intentions onto a nature devoid of them*, or of divine intentions that we are in no position to fathom
>
> (Des Chene 2001: 11; my emphasis).

And since we have no access to divine intentions, the only recourse for identifying teleology in the natural world (in this case, functions) is through the projection of human intentions. Similarly, in a paper on Cartesian health, Manning summarises a version of the reading as follows:

> [f]or the physicians who worried that the health of a machine could not apply to the health of the human being, Descartes could remind them that they were getting things backwards. The health of the machine is parasitic on the health of the human being, not the other way around
>
> (Manning 2013: 261).

This is both the problem and a solution to it in a nutshell. The health of a machine cannot apply to the health of a human being precisely because, as established above, extended substance in itself lacks the resources to ground teleology. But, Manning claims, this is the wrong way around: human health is not modelled on machine health; machine health is modelled on human health. That is, reductionist accounts such as Shapiro's attempt to account for human health in terms of machine health, and they fail because machine health can only be accounted for in terms of human health. Manning goes on to explain:

> [f]or animals and other living things, the intrinsic denomination of nature to which their extrinsically denominated 'nature' relates is the human being's body when in union with the mind. In their case, however, it is through the intermediary of the human machine that they relate to the appropriate intrinsic denomination of 'nature'
>
> (Manning 2013: 262).

Here, Manning refers to Descartes's use of 'natures' in Meditation Six's discussion of teleology, where Descartes writes,

> when I consider the purpose of the clock, I may say that it is departing from its nature when it does not tell the right time; and similarly when I consider the mechanism of the human body, I may think that, in relation to the movements which normally occur in it, it too is deviating from its nature if the throat is dry at a time when drinking is not beneficial to its continued health. But I am well aware that 'nature' as I have just used it has a very different significance from 'nature' in the other sense. As I have just used it, 'nature' is simply a label which depends on my thought; it is quite extraneous to the things to which it is applied, and depends simply on my comparison between the idea of a sick man and a badly-made clock, and the idea of a healthy man and a well-made clock. But by 'nature' in the other sense I understand something which is really to be found in the things themselves; in this sense, therefore, the term contains something of the truth.
>
> When we say, then, with respect to the body suffering from dropsy, that it has a disordered nature because it has a dry throat and yet does not need drink, the term 'nature' is here used merely as an extraneous label. However, with respect to the composite, that is, the mind united with this body, what is involved is not a mere label, but a true error of nature, namely that it is thirsty at a time when drink is going to cause it harm
>
> (CSM i: 58–9; AT vii: 85).

If I deviate from my nature by drinking when drinking is unhealthy, I deviate from an intrinsic norm. If a clock deviates from its nature by failing to keep time, however, the norm it deviates from is extrinsic: it is in the 'nature' of a clock to keep time only in relation to the ends of intentional creatures that use clocks to tell time. The mechanisms of extended substance themselves, Descartes says, cannot be treated as having intrinsic norms; whether or not it keeps time makes no difference at all to the clock in itself – that norm does not inhere in the mechanisms themselves but is an 'extraneous label' applied by minds. The union, however, can have intrinsic norms: edema causes a 'true error of nature' – it is 'true' in that the nature is not, in this case, an extraneous label but inheres in the union in question (it is 'really to be found in the

[thing itself]'); unlike a clock, a union in itself is capable of having (and does have) ends, health chief amongst them (*Passions* 2/52; AT xi: 372).

Manning's point is that health in non-human living creatures is an extraneous label applied by virtue of comparison to the human body, which gets its 'health' by virtue of the inherent nature of the union of which it is a part. In the same way that the human body considered in itself can be described as healthy by reference to the union, so can the animal – just at one further remove: the animal is healthy by comparison to the human body which is healthy with reference to its union. Manning expands on this reading in a recent paper[19]:

> the abstraction that sets up the comparison between us and animals is an abstraction from the person's body to the human body [. . .]. Yet Descartes's point of departure remains the person's body. Fundamentally, Descartes's biology involves (1) using what we know about the person's body and then (2) abstracting to the human body (that it has certain sense organs, behaves and moves in certain ways, etc.) (3) to identify analogs in the world (those things with a similar shape, sense organs, behavior, and movements) and then (4) to attribute causes to those analogs given what we know about the human body [. . .].
>
> My proposal is that *the person's body sets the agenda for Descartes's biology and that Descartes's practice commits him to the view that the living bodies in the world have a nature similar to the person's body*. In other words, *Descartes's ontology of natures is not an ontology of de facto physical natures [. . .] but, rather, an ontology of projected natures*. The human body and animal bodies have natures that cannot be reduced to the nature of body, given that they are identified through an abstraction from the person's body. Just as the person's body can be corrupted and 'true errors of nature' can occur, by projecting our nature onto other living things we enable ourselves to find analogs to the 'true errors of nature' we initially identified in ourselves
>
> (Manning 2015: 232; my emphases).

Here, Manning adopts the terms 'human body' to refer to the human body in itself and 'person's body' to refer to the human body as involved in a union with a mind (2015: 228), but his position remains consistent. He concludes that we do identify normative natures in addressing living things, but they are 'projected natures' rather than 'de facto physical natures' inherent in extended substance. And the projection works, ultimately, by analogy with the person's body – that is, the body in the union.

[19] In which he uses it to ground the disciplinary identity of Cartesian biology. *Cf.* Ch. 3, §3.3.3 here, which argues against the need for any such disciplinary identity.

6.3.4.2 Projectionism, antirealism, and real irreducibles

There might seem to be a problem with the projectionist reading: it might appear to be antirealist about teleology. If teleology is nothing but a projection of human ends onto a world intrinsically devoid of ends, then natural teleology is, presumably, not real. At first glance, antirealism about teleology in the physical world ought to be a distinct strength of the projectionist reading: if no teleology inheres within animals or plants, then Descartes has not contravened his ontology of extended substance. However, this seems to put Descartes in the position of claiming that the sheep that flees the wolf (AT vii: 230) has nothing of its own to preserve in doing so[20]; its action is comparable to what a human would do out of a self preservation that the sheep itself lacks. Such an interpretation is by no means out of the question – the sheep is, after all, an automaton that seems to have been designed to produce certain behaviours under certain conditions. But, at the very least, it seems counterintuitive to claim that actions that do in fact preserve an animal's health (in that they keep it operating) have nothing real to preserve.

This is indeed a problem if we maintain that only reducibles are real for Descartes: in that case, projectionism can be nothing but projection; in that case, projectionism is the imposition of human ends on a world to which they are purely extrinsic. But, as this chapter and the previous have shown, Cartesian knowledge need not be reductionist, and, as Chapter Four showed, Descartes can allow irreducibles into his ontology. On that understanding, the irreducibility of natural teleology does not imply its unreality. Natural teleology is simply another epistemic gap in Descartes's dualist system: it cannot be accounted for within that system, but the epistemology of the dualism does not exhaust Descartes's means of knowledge acquisition. The irreducibility of natural teleology does mean that we cannot have knowledge of its independent existence. But we can still know of the existence of natural teleology insofar as it is not independent of us.

What this means concretely is that the teleology we see in the material world is always going to be combined with our own, human teleology in some way, whether by identifying in animals the same health that we maintain, or by analogy with our own bodies, or by some other means. Whatever natural teleology we can know can only be

[20] In a letter to More, Descartes suggests that health, specifically, pertains only to humans (5 February 1649; AT v: 270). This, in turn, suggests that it is meaningless in relation to animals. It is not entirely clear how serious Descartes is in that passage, but, even if we do understand him to deny animal health, he nevertheless takes the sheep to run from the wolf. There does seem to be something in the sheep itself that causes that behaviour – it seems to be more than simply a projection *simpliciter*. See Des Chene (2001: 150).

known in connection with our own ends. This is why Cartesian natural teleology needs to be projectionist: we cannot know it except insofar as it is inextricably wrapped up with human teleology. This is also why Shapiro's attempt to provide a reductionist account of bodily health ends up relying on a conception of boundary relative to human ends. In no way does this undermine the reality of natural teleology: real natural teleology is simply something that cannot be known independently. If natural teleology is a real irreducible, then the antirealism problem ceases to be an issue: Descartes's system lacks the resources to provide a reductionist grounding for it, but there really is identifiable teleology in the physical world.

6.3.5 The risk of arbitrary knowledge

The obvious objection to the real irreducible reading is that it seems to risk arbitrariness. Given Descartes's extensive use of teleology, interpreting natural teleology as real but irreducible appears to allow an awful lot into his biology that is not subject to the constraints and checks of his wider system. If we allow him this much, if irreducible teleology can legitimately permeate Descartes's biology, what prevents him from importing sundry other things ruled out in his ontology? In other words, if teleology, why not powers and forms? Part of the answer is that Descartes quite effectively makes powers and forms redundant within his system: he puts considerable work into showing that everything they explain is (at least) equally explicable using the elements of his ontology. As we have seen, teleology and the union cannot be similarly reduced away. Nor, it seems, can they be simply eliminated or avoided: Descartes cannot deny our sensory knowledge of our being unions, and, evidently, he cannot explain a whole range of biological phenomena without involving teleology. Thus, there are two conditions for Descartes to treat a phenomenon as a real irreducible: it must (of course) be irreducible, and it must be ineliminable. Consequently, powers and forms are not a concern because of their reducibility, while, say, magic is not a concern because Descartes can, and does, avoid it entirely. Knowledge of real irreducibles, then, is not arbitrary and not without conditions: it is only what Descartes cannot avoid and cannot reduce that needs to be treated in this way.

Simmons' treatment of Cartesian natural philosophy shows how this approach works concretely. On Simmons' account, Descartes's objection to the use of teleology in natural philosophical explanations is an objection to 'the ways in which the attribution of ends has interfered with the pursuit of efficient causes' (2001: 69). The problem Descartes has with occult powers is that they allow explanations to bottom out at higher levels, when there are lower-level, micro-mechanical explanations still to be had

(2001: 70–2).[21] But aspects of teleology can work perfectly well as 'placeholders' (Simmons 2001: 71), such that 'the sort of functional analysis in which Descartes engages amounts to the first step toward (what he views to be) a proper investigation of some of the underlying mechanical causes' (Simmons 2001: 75). Thus, Descartes allows teleology into natural philosophy in order to reduce it away where possible. Whatever cannot be reduced away, and cannot be eliminated (because, e.g., the blood-pumping, as opposed to sound-making, function of the heart subtends the mechanical explanation), remains as a real irreducible.

6.4 Life

6.4.1 Life beyond eliminativism

Within the confines of his dualist ontology, Descartes can only be an eliminativist about life. This much was established in Chapter Three. There is nothing either material or mental (or accessibly theological) for a concept of life to be reduced to. This, I've argued, is fine: Descartes can do everything he needs to in biology in the total absence of any well-defined, principled concept of life. It is in this sense that he is an eliminativist, rather than a reductionist, about life. If Descartes cannot reduce life to anything in his ontology, one conclusion to draw is that, for him, life is nothing at all, as Chapter Three claimed. In this section, I am going to draw a second conclusion: that life is still a meaningful category for Descartes, despite his eliminativism. This means that Descartes both gets to be a strict eliminativist about life and gets to be what amounts to a kind of vitalist. The claim is that he is a vitalist in the, admittedly broad, sense that he has a weak metaphysical commitment to the existence of life. His 'vitalism', however, is entirely nonfunctional, in that it plays no role whatsoever in his natural philosophy.

For any kind of vitalism to be compatible with eliminativism about life seems more than a little counterintuitive. Even in its broadest sense, vitalism must involve taking life to be something or other, while eliminativism is precisely the claim that it is nothing. The resolution of that tension comes from taking Descartes to be an eliminativist with respect to the ontology of his dualist system, and a quasi-vitalist outside that ontology. My argument here will be that life is eliminated exactly because the dualist ontology lacks the resources to account for life, just as it lacks the resources to account for the union and teleology. By itself, though, that does not necessarily mean that there is no such thing as life for Descartes. All it means is that the dualist system

[21] Ch. 1 here deals extensively with levels and mechanical explanations.

cannot tell us what life is. That could still be because there is nothing real there to define (and so eliminativism holds regardless). But it could instead be because of a simple epistemic gap in the dualism, as we have seen above for the union and teleology. The position I am advocating here is that, despite its indefinability in the terms of the dualist ontology, a nonreductionist notion of life is indeed available to Descartes.

6.4.2 Life and indefinability

6.4.2.1 Everyone knows what life is

In a paper on the definition of life, the biochemist Daniel Koshland Jr recounts an anecdote from a conference dedicated to the subject:

> After many hours of launching promising balloons that defined life in a sentence, followed by equally conclusive punctures of these balloons, a solution seemed at hand: "The ability to reproduce—that is the essential characteristic of life," said one statesman of science. Everyone nodded in agreement that the essential of a life was the ability to reproduce, until one small voice was heard. "Then one rabbit is dead. Two rabbits—a male and female—are alive but either one alone is dead." At that point, we all became convinced that although everyone knows what life is there is no simple definition of life
>
> (Koshland 2002: 2215).

Koshland takes the lesson here to be that we need a non-simple definition of life. Since we all know what life is, there must be some definition available, he assumes. But simple definitions – by which he seems to mean those that reduce life to a single characteristic, such as the ability to reproduce – are not going to be able to do the job. What he proposes instead is the reduction of life to multiple basic principles, which can be instantiated in various ways. This bears more than a passing resemblance to Life_{MK}, as discussed in Chapter Three (p. 66 above). (And, like Life_{MK}, Koshland's definition suffers from some degree of arbitrariness, amongst other issues.[22])

There is a different lesson to be drawn from Koshland's anecdote. And that is that the story shows, succinctly, that being unable to define life is not inconsistent with knowing what life is. We can all know what life is and and still not be able to say, in any principled way, what it is that life consists in. We can consistently distinguish living from non-living even if we can't definitively point to specific features on which that

[22] Ruiz-Mirazo et al. claim that it 'lacks [. . .] explanatory power' and is 'clearly redundant' (2004: 326); it also fails to account for various counter-examples (Cleland and Chyba 2002: 388), such as primordial life (Zhuravlev and Avetisov 2006: 282).

distinction depends – that is, even if we can't find a reductive analysis of life or turn it into a natural kind (at least, not under a reductionist conception of nature). Put otherwise, this is a rejection of Koshland's assumption that our recognition of life implies that there is still a definition to be found: Descartes knows what life is even though he makes life entirely indefinable.

6.4.2.2 Descartes and superfluous terms

In Chapter Three, I argued that Descartes's frequent references to life, and his explicit use of it as a category, are not incompatible with eliminativism about life for two reason. First, because he uses 'life' as a folk term, where doing otherwise would be inefficient. And second, because he uses it as an Aristotelian term, with the intention of showing that he can explain everything the Aristotelians take to be encompassed by life, without requiring the addition of souls. Both these reasons stand. But the problem with this approach to Descartes's use of the term and category is that he never acts as if he takes the term itself to be meaningless, as we might well expect him to, if what he's doing is making the point that what others call 'life' fails to refer to anything within his ontology. He never claims that 'life' itself is fictitious (while he, of course, can nevertheless account for all the phenomena others have associated with it); he simply talks of life just as anyone who takes the category to be real would. And while Descartes does have a habit of appropriating established terms for his own, very different, purposes, he is not one to suffer false concepts silently. Take, for instance, his rejection of forms and qualities in *The World*:

> [o]thers may, if they wish, imagine the form of fire, the quality of heat, and the process of burning to be completely different things in the wood. For my part, I am afraid of mistakenly supposing there is anything more in the wood than what I see must necessarily be in it, and so I am content to limit my conception to the motion of its parts. For you may posit 'fire' and 'heat' in the wood, and make it burn as much as you please: but if you do not suppose in addition that some of its parts move about and detach themselves from their neighbours, I cannot imagine it undergoing any alteration or change. On the other hand, if you take away the 'fire', take away the 'heat', and keep the wood from 'burning'; then, provided only that you grant me there is some power which puts its finer parts into violent motion and separates them from the coarser parts, I consider that this power alone will be able to bring about all the same changes that we observe in the wood when it burns
>
> (CSM i: 83; AT xi: 7).

Fire and heat, as things in their own right, distinct from the material, mechanical activity of corpuscles, are excised from the account as superfluous. Descartes tells us,

with some condescension, that we can talk about fire and heat if we want, but we'd be wasting our time in doing so: there's no fire as such, and there's no heat as such; there's only corpuscle activity. Similarly (and not unironically, given the present context), his rejection of the soul as the principle of life is both vociferous and explicit. As we have seen before, Descartes considers vegetative souls to be redundant (e.g. AT i: 523; AT iii: 371) and the psychistic account of life to be a 'very serious error' (CSM i: 329; AT xi: 330).

So why is the attribution of life to humans, animals, and plants not also an error? If Descartes expressly rejects forms, qualities, and vegetative souls (amongst other things) for their superfluity, it seems as though he should do the same with life. We might expect him to note the bankruptcy of the term and flag his own use of it as purely pragmatic, as with his occasional use of, e.g., 'form'.[23] As established in Chapter Three, he has good reason to distance himself from his use of the term – but he doesn't. This is, perhaps, only a small puzzle, but it is one without an entirely satisfactory resolution as long as we stay purely within Descartes's reductionist project: Descartes might be an eliminativist about life, but he does not seem to treat it as a false category.[24]

6.4.3 Indefinability and irreducibility

That Descartes does not attempt to distance himself from his own use of 'life' could just be an oversight on his part. To an extent, it is plausible that he could make use of the term without fully thinking through the consequences. But Descartes is rarely, if ever, careless with his language; and he certainly put a great deal of thought into matters of biology. With that in mind, simple negligence doesn't seem a promising answer to the puzzle at hand. So, let's take him seriously when he claims not to deny life to animals (AT v: 278). Let's assume that, when he talks about 'life', he knows what it is. But let's also assume that he knows what life is while still maintaining that he is an eliminativist about life.

[23] For instance, in the *Description of the Human Body*, Descartes describes the yeast-acting blood particles in the heart as separating particles of new blood 'from one another, and in separating thus they acquire the form of fire' (DHB: 203; AT xi: 282).

[24] The situation is different from that of teleology in one significant way: Descartes helps himself to teleological terms while also denying teleology in the material world, or at least our access to knowledge of it. By contrast, he is committed to eliminativism about life, but he never explicitly tells us that there is no such thing.

Under a single-domain model of conceivability, that would presumably be a contradictory proposition. But we know that Descartes's major domain of conceivability, his dualism, can have epistemic gaps about things that we nevertheless know: everyone knows what the union is (they know it in the course of their ordinary lives), but the union is nevertheless indefinable in the terms of Descartes's dualism. In §6.3, I argued that the various forms of teleology Descartes includes in his biology might be appropriately addressed as 'real' features of the world that also happen to be irreducible to anything within his dualist ontology. There are good reason to think that the same goes for life: life constitutes an epistemic gap in Descartes's dualism, but it is no less real for that. However, the case for life as a real irreducible is distinct from that of teleology in a way that makes it somewhat stronger. That's because, although Descartes does reject teleology while still making implicit use of it, he never explicitly affirms its presence in the material world. But he does explicitly affirm the presence of life.

Descartes provides a relatively strong statement that there is indeed such a thing as life in the letter to Regius quoted at the beginning of Chapter Three, where Descartes writes,

> [s]ince "self-moving" is a category with respect to all machines that move of their own accord, which excludes others that are not self-moving, so "life" can be taken as the category [vita *sumi potest pro genere*] which includes the forms of all living things
>
> (to Regius, June 1642; CSMK: 214; AT iii: 566; translation adjusted).

Descartes is equating the existence of 'life' as a category with that of 'self-moving' as a category: the former encompasses all living things just as the latter encompasses all self-moving things. But 'self-moving' is reducible and therefore definable within Descartes's ontology. A self-moving thing is a thing that contains its own principle of movement, rather than being moved by external causes. And since Descartes takes movement to be a mode of extended substance, 'self-moving' can be reduced in the terms of his ontology.[25] The category requires no additional metaphysical commitments from Descartes; his commitment to extended substance already covers everything needed. It makes good sense, then, for 'self-moving' to be an existent category: it is both a category we recognise and one for which we can access well defined conditions for membership. We know that to belong to the category is to have an internal

[25] That said, the boundary problem (see Des Chene (2001: 132) and p. 152 above) undoubtedly applies to the 'self' part of 'self-moving'. It might turn out that, instead of 'life' operating on the model of 'self-moving', 'self-moving' operates on the model of 'life'. That is, it might be that the category of 'self-moving' is also a real irreducible that constitutes an epistemic gap in Descartes's dualism.

principle of self movement. For life, on the other hand, we do recognise the category, but the conditions of membership are indefinable: to belong to the category 'life' is just to be alive, but we can say nothing definitive about what it is for a category-member to be alive.

According to Descartes, then, 'life' is an existent category with indefinable membership conditions. This is entirely consistent with the situation for the union, which we know to exist but is nevertheless indefinable. Given that, a notion of life is indeed available to Descartes, as a real irreducible, on the model of the union. And if we allow him that notion, we can make sense of his unapologetic endorsement of the category and use of the term. On this reading, even though life is irreducible within his ontology, the category is just as real as the category of 'self-moving'. By the same token, he can meaningfully and legitimately describe animals, people and plants as 'living', distinguish between living and dead eels (AT ii: 66), or even claim that life ends when any of the principle parts of the body stops working (AT xi: 330; see Ch. 2, §2.4.3) – all without being able to say what it is to be alive, in what the distinction between living and dead eels consists, or what it is that ends when the body breaks down. In all these cases, Descartes can do no more than appeal to life itself.

In her paper on Descartes's conception of life, MacKenzie asks for a definition in terms of 'what is asserted by the whole sentence "x is alive"' (1975: 2). Given all the above, alongside the conclusions of Chapter Three, this is the only definition Descartes can provide:

Life_D := x is alive if and only if x is alive.

Clearly, this is not what MacKenzie had in mind; a tautologous definition is not an informative one. But that does not prevent Descartes from having a meaningful notion of life, just as he has a meaningful notion of the union. The issue is that we can't say anything more about it, at least not in the terms of his dualist ontology. But that is a secondary issue. What is crucial is that this is a definition that Descartes does get to employ. It turns out that appealing to life itself is, against expectations, a real option for Descartes.

6.4.4 Eliminativism, nonreductionism, and vitalism

6.4.4.1 Eliminativism and nonreductionism about life

In Chapter Three, I argued that Descartes is not a reductionist about life itself because there is nothing in his ontology to which life can be reduced (and, not incidentally, also

because he makes no attempt to provide a reductionist account). Within the confines of his dualism, he is an eliminativist about life. And in the present chapter so far, I have argued that Descartes nevertheless does have a meaningful notion of life, as a real irreducible. That means that Descartes is both an eliminativist about life and a nonreductionist about life. That is an odd conclusion to reach if eliminativism is, as it is generally taken to be, a particularly thoroughgoing form of reductionism. Eliminativism and nonreductionism about the same thing ought to be mutually incompatible, and that ought to be a problem.

There is a way to resolve this without accusing Descartes of gross inconsistency. And that, as suggested above, is to understand Descartes as an eliminativist about life in one domain of conceivability and a nonreductionist in another. The point need not necessarily be couched in terms of separate domains, but that is a usefully revealing way of analysing what's going on in Descartes's disparate treatments of life. Within the domain proper to his dualism, Descartes can only be an eliminativist about life – and within that domain he is, as Chapter Three showed, fully eliminativist. But outside that domain, he is free to recognise the category of 'life' and to be nonreductionist about it. And we do know that there is an outside to that domain for Descartes, because that's where the notion of the union resides.

In this way, there is no problem of incompatibility: eliminativism about life is fully compatible with nonreductionism about life as long as the two positions are particular to different domains. This is presumably the de facto present-day situation with certain strands of neuroscience and traditional psychology (or even folk psychology). The one is eliminativist about certain things that are treated nonreductively by the other. But they belong to different domains, with different ontologies and different epistemic aims, so there is no necessary problem of compatibility between them. That is, of course, there is no problem of compatibility unless we try to collapse the one into the other.

For his part, however, Descartes shows no interest in trying to collapse the two domains. We saw this in the case of the union (Ch. 4 and §6.2 above). And we see the same thing in this section and Chapter Three, in the way Descartes addresses life. He never attempts to reduce life itself to the elements of his dualist ontology, nor does he ever express the desire to. He undoubtedly is interested in attempting to reduce various phenomena associated with life, but not to reduce life itself. We would say he had no interest at all in life itself, if it weren't for his affirmation of the category in the letter to Regius, along with various non-trivial uses of the term. That he does all this

with absolutely no handwringing, with no attempt to explain the apparent contradiction, gives us good reason to think that he was not interested in trying to overcome the incompatibility through domain collapse. Given this, and given his willingness to maintain a separate domain with respect to the union, it seems reasonable to conclude that Descartes is an eliminativist about life in one domain and a nonreductionist about life in another.

6.4.4.2 Descartes's eliminativism and vitalism

Vitalism has a long history of the being the bogeyman of the life sciences. Painted as the baseless supposition of some magical life force, it gets taken to be the disreputable counterpart of serious biological research. Perhaps the only area in which Descartes's programme in biology has retained some mainstream respectability is its apparent use of hard-nosed reductionist mechanism as a repudiation of the Aristotelian, Galenic, and Paracelsian supposed vitalisms that preceded it. And now I am claiming that Descartes thinks there is such a thing as life in itself, and that it is irreducible into ontologically acceptable terms. That might seem like a cause for concern over whether this reading ruins the one aspect of Descartes's biology that is well regarded. Does it, in other words, turn him into some kind of vitalist?

If vitalism is understood in its bogeyman form, then that concern is easily dismissed. Nowhere does Descartes posit, or sanction, any non-natural life force. Indeed, the arguments of Chapter Three stand: what Descartes does is to methodically, repeatedly, and explicitly reject any cause of vital phenomena that falls outside the properties intrinsic to his extended substance. While, on my reading, he does also have a notion of life as an irreducible, it is kept entirely separate from his treatment of biology, and is accorded no explanatory power or role. This is a long way from the kind of vitalist approach that is supposed to rely on some vital force to make its biology work. Even on my reading, Descartes still excises mysterious forces from the science of biology. His sober materialist position abides (even if, if I am right in this dissertation, his reductionism is looking ragged at the edges), and the reputation of his biology stays intact.

However, vitalism rarely took its bogeyman form. Wolfe (2014; 2015; Wolfe and Terada 2008) distinguishes between what he calls 'substantive' and 'functional' vitalisms. Substantive vitalism is the metaphysical commitment to the living thing as a distinct metaphysical substance of some kind. This is the kind of vitalism found in the work of Stahl or Driesch, which, with their talk of anima and entelechies, most resemble the

form of vitalism reviled by twentieth-century biologists. But, as Wolfe shows, substantive vitalism is a poor description of the work of, for example, the Montpellier Vitalists ('the ones for whom the term "vitalist" was coined!' (Wolfe 2015: 9[26])). Barthez, he argues, came closest to adopting a substantive approach, but then explicitly abandoned all interest in metaphysical significance:

> Paul-Joseph Barthez, the Dean of the School [. . .] had initially asserted the existence of an independent vital force, but withdrew this and added a chapter to the second edition of his book entitled "Skeptical considerations on the nature of the vital principle" (Barthez [1858], III, p. 96f.). He warned that one should follow an "invincible skepticism" (p. 32) or a "reasonable Pyrrhonism" (p. 274) when it comes to the vital principle. He only "personified" the vital principle, he explains, for ease of argument (p. 126). In a wonderful phrase, he says: "I am as indifferent as could be regarding Ontology considered as the science of entities" (Barthez 1806, p. 96, n. 17)
>
> (Wolfe 2015: 6).

Barthez's work is concerned with the investigation of vital phenomena, but, thanks to his 'scepticism' and 'indifference', he remains agnostic about the metaphysical status of the vital principle itself. Elsewhere, Wolfe identifies this approach, in both Barthez and the rest of the Montpellier School, amongst others, with a Newtonian positing of an unknown as an object of research – what he calls, in a neat phrase derived from Hall, a 'provisionally inexplicable explicative device' (Wolfe 2014: 255). This is a functional vitalism: vitality itself is not at stake, but it does serve to drive the research.

On the face of it, at least, this functional vitalism looks a lot like Descartes's treatment of life. He accounts for vital phenomena piecemeal, while maintaining an indifference towards the status of life itself. And Chapter Three's characterisation of 'life', in Descartes's use, as either a folk term or an Aristotelian term (Ch. 3, §3.3.2), could certainly be read as 'personifications' of life purely for the ease of argument, per Barthez. There is a significant difference between this and functional vitalism, however: for Descartes, life is entirely non-functional.

Life is non-functional for Descartes because it does not serve at all to drive his research. This is precisely what the conclusion of Chapter Three amounts to: Descartes is careful to address all the phenomena of the body without reference to life. The questions he deals with are never about how such-and-such a process contributes to life, but how such-and-such a process contributes to locomotion, or sensation, or the

[26] Quotations, and pagination, from Wolfe 2015 are taken from Wolfe's original English text.

continuation of the heartbeat individually, and so on. When Descartes does refer to living and non-living (such as in articles five and six of *The Passions*), it is to point out how very banal a distinction that really is, and how death is entirely due to the purely material breakdown of certain parts of the body. The difference between dead and living, after all, comes down to the difference between a broken watch and an intact and wound watch (a. 6). Even if Descartes does have an additional notion of life as an irreducible, it has no role in his accounts of the operation of the body. Whatever that notion might be, it is undoubtedly non-functional; there is nothing explicative about it.

So, Descartes's notion of life is non-functional. On the other hand, if we do take seriously his affirmation of the existence of the category of 'life' and use of the term, it does imply some metaphysical commitment. Unlike with 'self-moving', the category of 'life' is not covered by pre-existing commitments (if it were, it would be reducible). And unlike Barthez, Descartes is not entirely indifferent: he tells us that 'life' is an existent category. This looks more like substantive vitalism. We would not want to call it 'substantive' of course (just because the exact ontological status of whatever is outside Cartesian dualism is necessarily obscure, making it a metaphysical jump too far to refer to life as a 'substance'). But it is closer to being substantive than functional: it is the claim that there is such a thing as life (whatever it may be) that is specific to Descartes's notion of life. With this in mind, Descartes's position on life seems to be something less than Montpellier Vitalism in the pragmatic, functional sense, because of its non-functionality, but something more in the metaphysical sense. At the same time, it appears to be straightforwardly something less than substantive vitalism, both because of its metaphysical obscurity and, and, because life itself has no role in Descartes's biology (Driesch's vitalism, for example, is substantive but still functional, in that entelechies play a central part in his biology).

Descartes is clearly not a vitalist in the bogeyman sense of the term. Given Wolfe's distinctions, however, we would be hard-pressed not to see Descartes as some sort of vitalist. He does have a metaphysical commitment to 'life' as a category (assuming we take him seriously on that count). That commitment is only implicit, and is, presumably, only a weak commitment to an obscure notion of life. It is also a commitment to an entirely non-functional notion. But, it is a commitment nonetheless. Descartes does seem to subscribe to a weak form of vitalism, even if only implicitly. Following Wolfe, we might call Descartes's position 'non-functional quasi-substantive vitalism'.

6.4.5 Why a non-functional notion of life still matters

The previous section and Chapter Three both emphasised just how non-functional life itself is for Descartes. This might well look like something of an objection against the argument here. If life is useless for Descartes's biology, it is not clear that there is a mandate for pressing the point about a nonreductionist notion of life, or for arguing in favour of a Cartesian vitalism. My response is this: the very uselessness of life is part of what makes Cartesian vitalism a compelling reading. In contrast to the cases of the union and teleology, life is a low-stakes commitment for Descartes. Nothing depends on its existence or on its precise nature. His inability to analyse life in the terms of his dualism poses no problem at all, because, if he happened to be mistaken about life, it would have no effect on anything else in his system. This allows him the luxury of making the unapologetic, if casual, metaphysical commitment to life that he does. Thanks to its non-functionality, the claim that 'life' is an existent category is a claim Descartes can afford to make. This means that the option of reflecting Koshland's observation that everyone knows what life is is open to him, with no need for concern over not being able to provide any kind of definition.

6.4.6 Knowledge of the non-independent existence of life

As established above, in order for knowledge of real irreducibles not to contravene Descartes's criteria for knowledge acquisition, their existence can only be known non-independently. The non-independent existence of the union was straightforward: I am the union that pertains to me, and I can nothing about its (nonsensical) existence independent of me. With natural teleology, our knowledge turned out to be tied up with our own ends. The situation is not so clear for life. It is not obvious what, specifically, knowledge of life is combined with. However, our original example of Cartesian non-independent knowledge was knowledge of appearances, acquired through the senses (p. 145 above). We do not need further specification to know that knowledge acquired through the senses is combined with ourselves. In the case of the appearance of the colour red, we can reduce the sensation and know what red consists in independent of our seeing it (as discussed above, it consists in the particular rotational motion of the minute particles propagating light). In the case of life, no reduction is available within Descartes's dualism, so we can know nothing about what life would be in our absence. We cannot specify what life would be for a rabbit or (perhaps more understandably) for a tree. We can only experience rabbits and trees as living and clocks as non-living: we cannot point to anything independent of us that constitutes their life. We can know what life is without being able to define it. If this sounds insufficient and disappointing, it needn't: all it means is that Descartes's dualist

system does not provide the resources to explain life in itself, independent of us, but that he can nevertheless uphold a commitment to the existence of life (whatever it might be).

6.4.7 Knowledge of life: vitalism and eliminativism

When Koshland notes that 'although everyone knows what life is there is no simple definition of life' (2002: 2215), he assumes that there is a (non-simple) definition of life available for the taking somewhere out there in the world, and that this definition will be accessible in terms established in the science. Descartes, by contrast, makes life utterly indefinable in the terms he's established. And yet he tells Regius that 'life' is the category that covers all livings things, and is distinct from but just as real as the category of 'self-moving'. He repeatedly and seemingly meaningfully talks of life, in various contexts. He simultaneously eliminates life from his biology and commits himself to the existence of life as a real irreducible. All this ought to make for a significant contradiction.

It needn't end up in contradiction, however, if all Descartes is doing is eliminating life from one domain of conceivability while asserting its existence in another. This is analogous with the case of the union. Moreover, this reading makes sense of what might initially be the most puzzling aspect of Descartes's treatment of life: that his use of the term and category is entirely unapologetic; he talks of life, but never provisionally or with qualification. This is not, I have suggested, mere negligence on his part. On the reading given here, he can legitimately refer to life because he really does take it to exist, in spite of its indefinability and irreducibility. In this way, Descartes gets access to a notion of life, while still being an eliminativist about life within the confines of his dualism. Without endangering the strict materialism of his biology, he even gets to be a vitalist (of some sort).

6.5 Conclusion

If Cartesian knowledge is purely reductionist, if we can have knowledge of the existence of only those things that can be reduced to the elements of Descartes's ontology, then Cartesian knowledge of irreducibles is a problem. Indeed, it's oxymoronic. But Cartesian knowledge needn't be purely reductionist. The reducibility criterion applies only to knowledge of the independent existence of external things with their particular essences. What we can have in the absence of reducibility, however, is knowledge of the non-independent existence of external things with their

particular essences. What this means is that we cannot have objective knowledge of irreducibles, but we can know them perfectly well from a subjective standpoint. For the union, this is relatively straightforward: I either am the union that pertains to me or, if I am just a mind, I am an intrinsic part of that union; consequently, I can know nothing about what the union that pertains to me would be *without* me (that concept is nonsensical), but I nevertheless know it 'very clearly' through my own involvement in it.

If natural teleology is interpreted in terms of the account of Cartesian nonreductive knowledge developed here, it ceases to be a problem for Descartes. That we cannot provide a reductionist account of teleology in the physical world means only that we can say nothing about what natural teleology would be in itself – that is, we cannot know it objectively. But we certainly can know it in combination with out own, human ends. This provides an epistemological basis for the projectionist readings of natural teleology given in the literature: we can only know natural teleology as a projection, or as a confused idea, but this does not imply antirealism about teleology in the physical world. Our inability to produce objective knowledge of it indicates not that natural teleology is not real, but simply that there is an epistemic gap in Descartes's dualist system. We can know natural teleology to be real while not being able to extricate our own ends from that knowledge.

Similarly, Descartes's treatment of life can be understood as a case of nonreductive knowledge. We established in Chapter Three that Descartes eliminates life itself from his natural philosophy. Here, I argued that this eliminativism is compatible with a weak metaphysical commitment to the existence of life itself as a real irreducible. Descartes can know what life is, and distinguish living from non-living, even without being able to give a reductionist account of what life consists in.

Conclusion

There are two main conclusions I want to draw from this dissertation. First, despite his apparent deep and systematic commitments to reductionism (in ontological, epistemological, and more broadly methodological forms), Descartes needs to rely on nonreductionism in order to account for biology. That is, I suspect, because of the complexity both of biological bodies themselves and of the practices needed to investigate them: while certain phenomena in, say, physics or meteorology appear to lend themselves fairly well to idealisation, to physical modelling, or to experimental isolation, biology complicates the matter considerably, especially given the techniques available in Descartes's time. Vivisection allowed for only poor isolation of phenomena, while isolating an anatomical structure would tend to destroy the active process at stake (i.e. the operation of the biological body). Descartes, then, had little choice but to address bodies as dynamic systems full of intradependencies and intra-actions. He could not effectively decompose them to the extent required for a strict reductionist account. We still can't.

Thus, as Chapter One showed, the mechanisms that Descartes relies on in accounting for biology are, for the most part, not the billiard-ball mechanisms of corpuscular mechanics but whole, dynamic systems. In order to be explanatory, those systems require non-lowest-level properties, such as activities, inter-level dependencies, and interdependencies. This reliance on interdependence carries over into Descartes's treatment of the 'principle of life', as discussed in Chapter Two. It turns out that, on Descartes's account, there is no single underlying principle that provides the motive force of the body; equally, and not coincidentally, there is no single foundational

epistemic principle of the science of physiology either (that is, there is no single principle that grounds Cartesian knowledge of the operation of the body). There cannot be such a principle, because the body's major systems are interdependent: provision of the body's motive force is a circular process that involves a variety of systems; and any knowledge of physiological operations depends on knowledge of all those systems and their interactions. Consequently, despite Descartes's appeals to the notion of a 'principle of life', the operation of the body can never be fully reduced to any one thing.

The second conclusion is that Descartes's philosophy includes, and relies on, nonreductionism even at the core of its epistemology and metaphysics. Or, at least, that there is the inclusion of, and reliance on, nonreductionism implicit in Descartes's epistemology and metaphysics. This was the argument of Chapter Four. His dualist system cannot account for the union of mind and body, because the union is irreducible to anything in his dualist ontology. That makes the union an epistemic gap in his dualism. Nevertheless, Descartes claims, we do have knowledge of the union. He never suggests that our knowledge of it is inadequate in any way, or that our knowledge is delegitimised by its irreducibility. I have argued that all that, along with Descartes's assertion that we have a primitive notion of the union, implies that there is an epistemology of the union separate from the epistemology of the dualist system. In addition, since the dualist metaphysics does not cover the union, if Descartes want to maintain that the union exists, he must be relying on an equally separate, implicit metaphysics to do so.

As argued in Chapters Four and Six respectively, the metaphysics and the epistemology of the union are subjective, as apposed to the objective view from nowhere that pertains to the dualist metaphysics and epistemology. They are subjective in that they are concerned entirely with the non-independent existence of things, or with our knowledge thereof. Epistemologically, our knowledge of the non-independent existence of a thing consists in our having knowledge of it in combination with ourselves. Ontologically, its existence is inextricable from our own. Consequently, as set out in Chapter Six, I can say nothing about what the union that pertains to me would be in my absence (because, of course, I am an inextricable part of that union[1]); similarly, I can say nothing about what natural teleology or life would be in themselves. If the union, natural teleology, or life could be reduced to the entities available within Descartes's dualist ontology, they would have objective ontological status. They cannot, so they have no objective ontological status. That does not mean that Descartes is an

[1] This is so whether I take myself to be a union or to be just a mind. See the discussion on p. 145 above.

antirealist about irreducibles such as the union, natural teleology, and life; it just means that, within his philosophy, these irreducibles are the kinds of things that exist non-independently.

All this means that Descartes's ontology is not as austere as he makes it out to be. There is more in Descartes's world than thought, extension, and God. There are, of course, unions too – unions, that is, that do not reduce to thought, extension, or God. And there are various forms of natural teleology, and there is life. If my analysis here is right, then there may well be more Cartesian irreducibles than I have addressed in this dissertation. I have already noted that the unity of a biological body[2], and perhaps the unity of any physical body[3], might be treated as a real irreducible. The argument from interaction in Chapter Four suggests that physical causation might be too (in that, if Descartes allows no secondary causes, physical causation can only be understood through a notion of mind–body interaction that is irreducible to thought or extension). Indeed, the account of irreducibles and nonreductionist knowledge developed here might be expanded to address Cartesian secondary causes and non-lowest-level properties (such as those discussed in Part One) in general: they are, after all, irreducible (or apparently irreducible) to anything in extended substance.

My position in this dissertation is not that Descartes should be read purely as a nonreductionist. Evidently, he should not. Nor is my position that nonreductionism is unconditionally 'better than' reductionism. Descartes makes great, and successful, use of reductionism. The majority of the *Meditations* attests to that, as do large swaths of his physics. Even the biology identified in Part One as nonreductionist still involves reduction to matter (just not to the lowest-level properties of that matter). I have focussed on the nonreductionism here because Descartes's reductionism is well-established and by no means short of recognition. But my ultimate point is that Descartes requires both: reductionism gets him a long way, but it has its failures, and it has its gaps. Where reductionism fails him, Descartes turns to nonreductionism. Where his dualist system cannot account for a feature of the world, he turns to irreducibles. And where distinctness becomes epistemically bankrupt, he relies on the epistemic productivity of confusion.

[2] See Ch. 6, p. 153, n. 16 above.

[3] See Ch. 1, p. 19, n. 13 above.

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Summary

Descartes is usually taken to be a strict reductionist, and he frequently describes his work in reductionist terms. This dissertation, however, makes the case that he is a nonreductionist in certain areas of his philosophy and natural philosophy (biology and the mind–body union in particular). This might seem like simple inconsistency, or a mismatch between Descartes's ambitions and his achievements. I argue here that it is more than that: nonreductionism is compatible with his wider commitments; moreover, allowing for irreducibles increases the explanatory power of Descartes's system. The dissertation begins by showing where, in Descartes's biology, reductionism fails him and he turns to nonreductionism (chapters one to three). It then looks at Descartes's epistemology and metaphysics, to establish the consistency of Cartesian nonreductionism (chapters four to six).

The first chapter assesses the basis for interpreting Descartes's natural philosophy as reductionist: his corpuscular mechanics. Reductionism does seem immediately apparent in Descartes's use of mechanism to explain the natural world. After all, natural phenomena are supposed to reduce down to the size, shape, position, and motion of tiny pieces of matter. Chapter one argues that Cartesian mechanism is not always so reductionist. It looks at a range of mechanisms in Descartes's treatment of physiology, including the heartbeat, respiration, and nutrition, amongst others. It concludes that the mechanisms Descartes uses to account for these phenomena are systems, and that they rely on non-lowest-level properties of those systems (e.g. organisation, interdependence, inter-level dependence) to do the explanatory heavy lifting. That is, those features are both necessary and irreducible. This contrasts

strongly with the standard picture of Cartesian mechanism as consisting in reduction to billiard-ball-like particle collisions.

The 'principle of life' to which Descartes frequently refers is usually identified with the 'fire without light' in the heart as the underlying principle of the operation of the body. Chapter two argues that Descartes has no such single underlying principle. It shows that his account of physiology explains the operation of the body through multiple interdependent systems, with no one system more fundamental than any other. As such, Cartesian physiology is incompatible with a hierarchical conception of a body whose operations are driven by a single underlying principle. That is, the operation of the body is not reducible to any one thing.

If the principle of life turns out to be irreducible, then what exactly does Descartes take life itself to be? Chapter three makes the case for his being an eliminativist, rather than a reductionist about life. The scholarship has made various attempts to attribute a principled, reductionist conception of life to Descartes, from cardiac heat to sets of life functions subtended by arrangements of bodily parts, to an ontologically distinct kind of complexity, and so on. The chapter shows that these attempts all either result in arbitrariness or break the coherence between biology and the rest of Descartes's system. I argue that Descartes's dualist ontology does not have the resources to produce a reductionist concept of life, and that his biology has no need for any such concept. What he does is to account mechanistically for individual physiological phenomena, rather than addressing life as such: he eliminates life itself from his account of physiology.

Chapter four argues that the union of mind and body is irreducible, for Descartes, when considered in terms of what he calls its 'primitive notion'. First, I argue that the union makes for an epistemic gap in Descartes's dualism: the reason he won't, and can't, explain it in the way he explains various properties of mind and body separately is that the union is indefinable in the terms of his dualism. What this tells us is that Descartes does not expect his dualist system to account for every single feature of the world: the union is one exception (chapter six argues that there are others). This means that Descartes allows for knowledge of things that are inaccessible for his standard epistemology: he needs a separate epistemology to address the union. The chapter then extends this analysis to metaphysics. This is more contentious. The idea is that, because the dualist metaphysics does not cover the union, Descartes's account of the union contains an implicit metaphysics that does.

Chapter five argues that the epistemological strategies of the *Meditations* should not be read into Descartes's natural philosophy. It argues that the role of reductionism in Descartes's project of knowledge acquisition in natural philosophy is to allow the intellect to make a judgement as to the independent existence of external things with their particular essences. This allows us to say, e.g., that colour does not exist independent of our perception of it, but that the rotation of tiny corpuscles propagating light does. The chapter makes that case through an analysis of a rule of knowledge acquisition that Descartes cites in several places: that almost no study time should be spent on matters that occupy the intellect alone, while almost all study time should be dedicated to matters that integrate sensation and imagination with the intellect.

Given that Descartes is willing to allow an irreducible, the union, into his system, the final chapter argues that he has means for integrating other irreducibles into his natural philosophy. It builds on the results of chapter five to argue that nonreductionist knowledge is perfectly consistent with Descartes's wider commitments, just so long as what it involves is knowledge of the specifically non-independent existence of external things with their particular essences. In other words, while we can't have objective knowledge of irreducibles, we can have subjective knowledge of them. I then use this reading to account for Cartesian knowledge of both natural teleology and life as irreducibles. The analysis of life extends the conclusions of chapter three by arguing that, while Descartes is an eliminativist about life in his treatment of physiology, he still has an ontological commitment to life as an irreducible, which I characterise here as a (weak) form of vitalism.

Samenvatting

Descartes wordt gewoonlijk aanzien voor een strikte reductionist, en hij beschrijft zijn werk zelf vaak in reductionistische termen. Deze verhandeling bepleit echter dat hij een nonreductionist is in bepaalde gebieden van zijn filosofie en natuurfilosofie (in het bijzonder wat biologie en de eenheid van lichaam en geest betreft). Dit lijkt aanvankelijk ofwel een loutere inconsistentie, ofwel een wanverhouding tussen Descartes' ambities en zijn verwezenlijkingen. Ik argumenteer dat er meer aan de hand is: nonreductionisme is verenigbaar met zijn bredere overtuigingen; bovendien versterkt het toelaten van onherleidbaarheden de verklaringskracht van Descartes' systeem. De verhandeling begint met aan te tonen waar, in Descartes' biologie, reductionisme hem in de steek laat en hij zich tot nonreductionisme wendt (hoofdstukken een tot drie). Daarna behandelt het Descartes' kennisleer en metafysica, met het doel de consistentie van Cartesiaans nonreductionisme te bepalen (hoofdstukken vier tot zes).

Het eerste hoofdstuk beoordeelt de basis van waaruit Descartes' natuurfilosofie geïnterpreteerd kan worden als reductionistisch: zijn corpusculaire mechanica. Reductionisme lijkt inderdaad onmiddellijk duidelijk in Descartes' gebruik van mechanisme om de wereld te verklaren. Tenslotte worden natuurlijke verschijnselen verondersteld herleidbaar te zijn tot grootte, vorm, positie en beweging van minuscule materiedeeltjes. Hoofdstuk 1 beargumenteert dat Cartesiaans mechanisme niet steeds zo reductionistisch is. Het kijkt naar een brede verzameling mechanismen in Descartes' fysiologie, waaronder hartslag, ademhaling en voeding. Het besluit dat de mechanismen waarvan Descartes gebruik maakt om deze fenomenen te verklaren

systemen zijn, en dat ze afhangen van eigenschappen van deze systemen die niet tot het laagste niveau behoren (o.a. organisatie en wederzijdse afhankelijkheid tussen componenten en niveaus) voor hun verklarende kracht. Met andere woorden, deze eigenschappen zijn zowel noodzakelijk als onherleidbaar. Dit contrasteert scherp met het standaardbeeld van Cartesiaans mechanisme als reductie tot botsingen tussen biljardbalachtige deeltjes.

Het 'principe van leven' waarnaar Descartes regelmatig verwijst wordt gewoonlijk geïdentificeerd met het "vuur zonder licht" in het hart als het onderliggend principe van de werking van het lichaam. Hoofdstuk 2 beargumenteert dat Descartes niet een enkel dergelijk principe heeft. Het toont aan dat zijn opvatting over fysiologie de werking van het lichaam verklaart aan de hand van verscheidene onderling afhankelijke systemen, waarbij geen enkel systeem meer fundamenteel is dan om het even welk ander. Om die reden is Cartesiaanse fysiologie onverenigbaar met een hiërarchische conceptie van een lichaam waarvan de werkingen voortgestuwd worden door een enkel onderliggend principe. Met andere woorden: de werking van het lichaam is niet herleidbaar tot een enkele zaak.

Indien het principe van het leven echter onherleidbaar blijkt, wat verstaat Descartes dan precies onder het leven zelf? Hoofdstuk 3 bepleit dat hij een eliminativist eerder dan een reductionist is wat het leven betreft. Binnen de literatuur over Descartes kan men verscheidene pogingen aantreffen om een principiële en reductionistische conceptie van het leven toe te schrijven aan Descartes, van harthitte tot klassen van levensfuncties onderspannen door schikkingen van lichamelijke delen, tot een ontologisch onderscheiden vorm van complexiteit, enz. Dit hoofdstuk toont aan dat deze pogingen allemaal ofwel uitlopen op arbitrariteit ofwel de coherentie tussen biologie en de rest van Descartes' systeem opbreken. Ik beargumenteer dat Descartes' dualistische ontologie de middelen mist om een reductionistisch concept van leven voort te brengen. Wat Descartes wel doet is individuele fysiologische fenomenen, eerder dan het leven als zodanig, mechanistisch uitleggen: hij elimineert het leven als zodanig uit zijn fysiologische opvatting.

Hoofdstuk 4 beargumenteert dat de eenheid van geest en lichaam volgens Descartes onherleidbaar is wanneer het opgevat wordt in termen van wat hij haar 'primitieve notie' noemt. Eerst beargumenteer ik dat de eenheid een epistemische kloof in Descartes' dualisme vormt: de reden waarom hij het niet wil en niet kan verklaren op de manier waarop hij de verschillende eigenschappen van geest en lichaam afzonderlijk verklaart is dat de eenheid ondefinieerbaar is in termen van zijn dualisme. Dit leert ons

dat Descartes niet van zijn dualistisch systeem verwacht dat het van elke eigenschap van de wereld te verklaren: de eenheid is een uitzondering (hoofdstuk 6 beargumenteert dat er nog andere zijn). Dit betekent dat Descartes kennis toestaat over dingen die ontoegankelijk zijn voor zijn gebruikelijke kennisleer: hij heeft een afzonderlijke epistemologie nodig om de eenheid te benaderen. Het hoofdstuk breidt deze analyse dan uit naar metafysica, wat meer omstreden is. De idee is dat, omdat de dualistische metafysica niet instaat voor de eenheid, Descartes' opvatting over de eenheid een impliciete metafysica die er wel voor instaat bevat.

Hoofdstuk 5 beargumenteert dat de epistemologische strategieën van de *Meditaties* niet gelezen mogen worden in Descartes' natuurfilosofie. Het beargumenteert dat de rol van reductionisme in Descartes' project van kennisverwerving in natuurfilosofie moet toestaan dat het intellect een oordeel kan vormen met betrekking tot het onafhankelijke bestaan van externe zaken met hun bijzondere essenties. Dit laat ons toe om bijvoorbeeld te stellen dat kleur niet onafhankelijk van onze perceptie ervan bestaat, maar dat dit wel geldt voor de rotatie van minuscule deeltjes waardoor licht voortgeplant wordt. Het hoofdstuk pleit voor deze stelling aan de hand van een analyse van een regel voor kennisverwerving die Descartes meermaals aanhaalt: dat zo goed als geen studietijd gespendeerd zou mogen worden aan aangelegenheden die enkel het intellect bezighouden, terwijl zo goed als alle studietijd gewijd zou moeten worden aan aangelegenheden die gewaarwording en verbeelding integreren met het intellect.

Aangezien Descartes bereid is een onherleidbaarheid, met name de eenheid, in zijn systeem toe te laten, beargumenteert het laatste hoofdstuk dat hij de middelen heeft om andere onherleidbaarheden in zijn natuurfilosofie toe te laten. Het bouwt voort op hoofdstuk 5 om te beargumenteren dat niet-reductionistische kennis perfect consistent is met Descartes' bredere overtuigingen, maar enkel zolang dit kennis over het specifiek niet-onafhankelijk bestaan van externe zaken met hun bijzondere essenties betreft. Met andere woorden, hoewel wij geen objectieve kennis over onherleidbaarheden kunnen hebben, kunnen wij er wel subjectieve kennis over hebben. Ik gebruik deze interpretatie om Cartesiaanse kennis van zowel natuurlijke teleologie en leven als onherleidbaarheden te verklaren. De analyse van leven breidt de conclusies van hoofdstuk 3 uit door te beargumenteren dat, hoewel Descartes in zijn benadering tot de fysiologie een eliminativist is wat leven betreft, hij niettemin een 'ontological commitment' heeft aan leven als een onherleidbaarheid die ik hier als een (zwakke) vorm van vitalisme karakteriseer.

Translation to Dutch by Boris Demarest